A Maturity Model and Interactive Tool for Building, Assessing, & Evolving Interoperable Information Systems

LISI & *Inspector*

August 2002 Blue Ribbon Panel Review

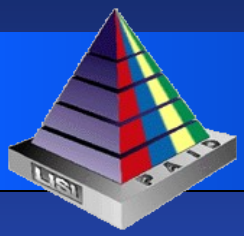
MITRE

Levels of Information Systems Interoperability

Agenda

- **LISI Overview**
  - Key Elements of LISI
  - Application to Architectures
  - Relationships to Other Constructs
- **The *Inspector* Tool**
  - Capabilities
  - New Features
  - Relationships to Other Tools
- **Example LISI Assessments**
- **CONOPs Considerations**
  - Internal MITRE Model
  - Government

Phases of LISI's & *Inspector's* Evolution

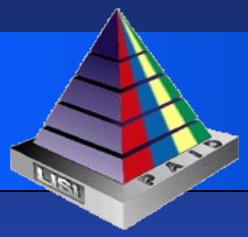


Desert Storm 1991

Exploratory Phase	Analysis Phase	Proof of Concept Phase	Application & Evaluation
Intelligence Systems Council	USDA&T, ASD(C3I), & J6 C4ISR Integration Task Force	ACC Interoperability Panel	DoD IC USCG
1994	1995-1996	1997-1998	1999-Current
Birth of Concept	DoD Endorsement	Architecture Framework Integration	Tool Evolution & LISI Applications

Inspector born

DPG 9 Study Group

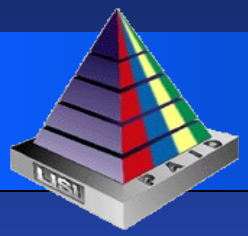


LISI Consortium Participants

IC CIO/JS J2P/JBC	JSBA/JIIB
US Coast Guard	Deep Water Project/CIO Enterprise Arch
DISA/N1	Inspector & Systems Repository
ASD C3I	JCAPS, CADM & NAD Integration
ESC CIPO	IOC for Tool & Pilot Assessments
MARCORSYSCOM	Integration w/MSTAR
BMDO	Aegis/Patriot
IC CIO	Collaboration Tool Assessments
Federal CIOs	Pilot assessment w/non-DoD Agencies
ASEO	Continued support to HTIO (Interop WG)
NIMA	Mapping Assessment Criteria
UCAO	Analysis of Common Operating Environments
SPACECOM	N/UWSS pilot assessment
Army/CECOM	Pilot Assessment of 20-30 systems

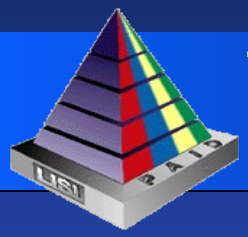
- Interested Parties
  - NAVSEA/PMS 378, DCTS, NIMA, NSA, ...
  - Treasury, Australia, Turkey, Italy, Germany, Norway, ...

The Key Elements of LISI
Levels of Information Systems Interoperability



What is LISI?

- A ***formal discipline and metric*** for measuring the level of interoperability at which systems are able to interact
- A ***maturity model and a process*** for profiling a system's capabilities and implementations in context with various levels of information-exchange interoperability
- A ***structured approach*** for comparing and assessing information systems to:
  - Identify interoperability gaps and shortfalls
  - Examine potential solution alternatives
  - Enable informed, interactive decision-making
- A Vehicle for ***cross-enterprise oversight and coordination*** of interoperability status and improvements



What Does LISI Enable Users to Do?

- **Ensure that all of the critical components of a system are addressed and aligned from cradle to grave**
  - ***Is TBMCS addressing the critical capabilities and dependencies that will enable its objective to be achieved?***
- **Identify and compare the specific ability of systems to interact *based on mission or process-related requirements*, e.g.,**
  - ***Do TBMCS and AFATDS interoperate as specified by their ICD?***
  - ***With other systems in context with flexible network-centric paradigm?***
- **Identify *all potential methods* currently available for system-to-system interaction, e.g.,**
  - ***How would today's TBMCS and AFATDS interact if they were unable to exchange the required USMTF messages?***
  - ***What other exchange options are readily available?***
- **Make informed implementation decisions for the future, e.g.,**
  - ***Are the TBMCS and AFATDS PMs' future implementation decisions improving the ability of these systems to interact?***
  - ***What solutions have other systems implemented that can be leveraged?***

The Fundamental Elements of LISI

The LISI Interoperability Maturity Model

provides a common basis for requirements definition and for incremental system improvements

Cross-domain information & applications sharing Advanced collaboration (Event-triggered global database update)	4 **Enterprise** Interactive manipulation Shared data and applications	
Shared databases Sophisticated collaboration (Common Operational Picture)	3 **Domain** Shared data "Separate" applications	
Heterogeneous product exchange Basic collaboration (Annotated imagery, maps w/ overlays)	2 **Functional** Minimal common functions Separate data and applications	
Homogeneous product exchange (FM voice, tactical data links; text files, messages, e-mail)	1 **Connected** Electronic connection Separate data and applications	
Manual Gateway (diskette, tape, hard copy exchange)	0 **Isolated** Non-connected	

The LISI "PAID" Paradigm

defines the interoperability attributes of information systems

What policies and procedures enable systems to exchange information, capabilities, and services?

What information formats, data protocols, or databases enable the exchange of data and information?

What set of applications enable information exchange, processing, or manipulation?

What environment (hardware, communications and networks, system services, and security) enables system interaction?

Procedures | Data | Applications | Infra-structure

MITRE

The LISI Capabilities Model

identifies the capabilities and the implementation options available for achieving each level of interoperability

LEVEL (Environment)		Interoperability Attributes P	A	I	D
Enterprise Level (Universal)	4 c	Multi-National Enterprises	Interactive (cross applications)	Multi-Dimensional Topologies	Cross-Enterprise Models
	4 b	Cross Government Enterprise	Full Object Cut & Paste		Enterprise Model
	4 a	DoD Enterprise			
Domain Level (Integrated)	3 c	Domain	Shared Data (e.g., Situation Display, Direct DB Exchanges)	WAN	DBMS
	3 b		Group Collaboration (e.g., Whiteboard, Chat)		Domain Models
	3 a		Full Text Cut & Paste		
Functional Level (Distributed)	2 c	Common Operating Environment (e.g., DII-COE Level 5) Compliance	Web Browser	LAN	Program Models & Advanced Data Formats
	2 b		Basic Operations (Excellent: Briefings, Pictures & Text; Good: Spreadsheets, Databases)		
	2 a	Program (Standard Procedures, Training, etc.)	Adv. Messaging (e.g., Message Parsers, E-Mail w/ Attachments)	NET	
Connected Level (Peer-to-Peer)	1 d	Standards Compliant (e.g., JTA)	Basic Messaging (e.g., Informational Text, E-mail w/o attachments)	Two Way	Basic Data Formats
	1 c		Data File Transfer		
	1 b	Security Profile	Simple Interaction (e.g., Telemetry, Remote Access, Text Chatter, Voice, Fax)	One Way	
	1 a				
Isolated Level (Manual)	0 d	Media Exchange Procedures	NA	Removable Media	Media Formats
	0 c	Manual Across Controls (NATO Level 3, NATO Level 2, NATO Level 1)		Manual Re-entry	Private Data
	0 b				
	0 a				

WANs: SIPRNET, JWICS, NIPRNET (Internet), DISN LES, VSAT, DISN

Nets: LINK 16, LINK 22, UHF Radio, VHF Nets, Ethernet, Token Ring

Example Implementation Options

Apps & Services: Imagery, Graphics, Mapping, Spreadsheet, Clipboard, Word Processing

Mapping: Chart, ARC INFO, ARCVIEW, ATLAS, CMTK, Dew Drop, Delorme, Edge, Hipparchus, Imagine, JMTK, MPEG Viewer, MUSE, Navig. Spheroids, OILSTOCK, Open Map, Raindrop, Spatial X, QT, TEM

Document Formats: .asc, .txt, .aw, .doc, .lwp, .pdf, .rtf, .wpx, .OR2, .OR3, .nsf, .htm, .sgm, XML

The LISI Assessment Process

Provides An Interactive Means to Improve Interoperability

Requisite System Capabilities

LEVEL (Environment)		Interoperability Attributes P	A	I	D
Enterprise Level (Universal)	4c	Multi-National Enterprises	Interactive (cross applications)	Multi-Dimensional Topologies	Cross-Enterprise Models
	4b	Cross Government Enterprise			
	4a	Govt Enterprise	Full Object Cut & Paste		Enterprise Model
Domain Level (Integrated)	3c	Domain	Shared Data (e.g., Situation Displays Direct DF Exchanges)	WAN	DBMS
	3b	Organization-wide Doctrine, Processes, Training, etc.	Group Collaboration (e.g., White Boards, VTC)		Domain Models
	3a		Full Text Cut & Paste		
Functional Level (Distributed)	2c	Common Operating Environment	Web Browser	LAN	Program Models & Advanced Data Formats
	2b		Basic Operations Documents Briefings Pictures & Maps Spreadsheets Databases		
	2a	Program Standard Procedures, Training, etc.	Adv Messaging Message Parsers E-Mail w/Attachments	NET	
	2d	Standards	Basic Messaging (e.g., Unformatted Text, E-mail w/o attachments)		Basic

WAN
SIPRNET
JWICS
NIPRNET
(Internet)
DISN LES
VSAT
DISN

Implementation Options

Services
Databases
Imagery
Graphics
Mapping
Spreadsheet
Clipboard
Word Processing

Document Formats

Mapping
Chart
ARC INFO
ARCVIEW
ATLAS
CMTK
Dew Drop
Delorme
Edge
Hipparchus
Imagine
JMTK
MPEG Viewer
MUSE
Navig. Spheroids
OILSTOCK
Open Map
Raindrop
Spatial X
QT
TEM

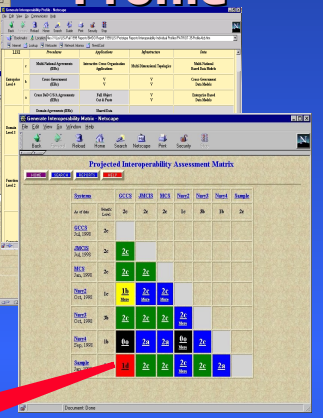
System Registration

Developers

Inspector

Questionnaire

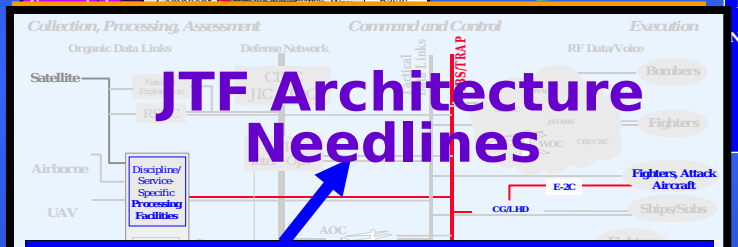
System Profile



Shortfall

Systems Assessment Levels Achievabl

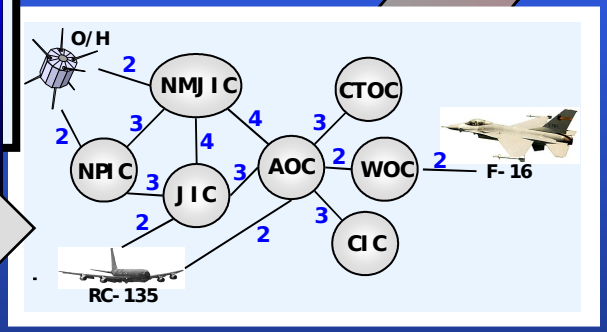
JTF Architecture Needlines



Target Folder Exchange Requirement (Heterogeneous Products, Shared Data)

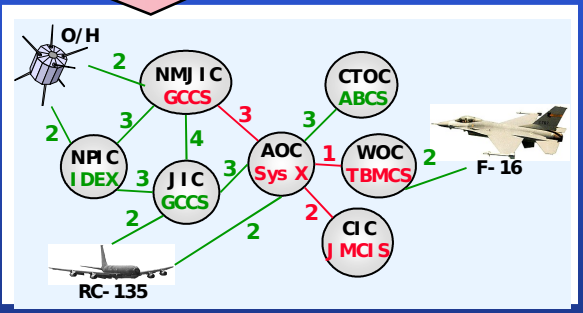
- **Level 2a if non-collaborative**
- **Level 3c if collaborative interplay**

CINC & JTF Operations



CINC Targeting Operations

***Required* Levels of Interoperability**



CINC Targeting Systems

***Actual* Levels of**

Application to
Enterprise
Architectues

LISI Provides an Audit Trail that Links System Capabilities to Business & Mission Operations

C4ISR Architecture Working Group (AWG)

DoD Architecture Framework
(C4ISR Extension in Process)

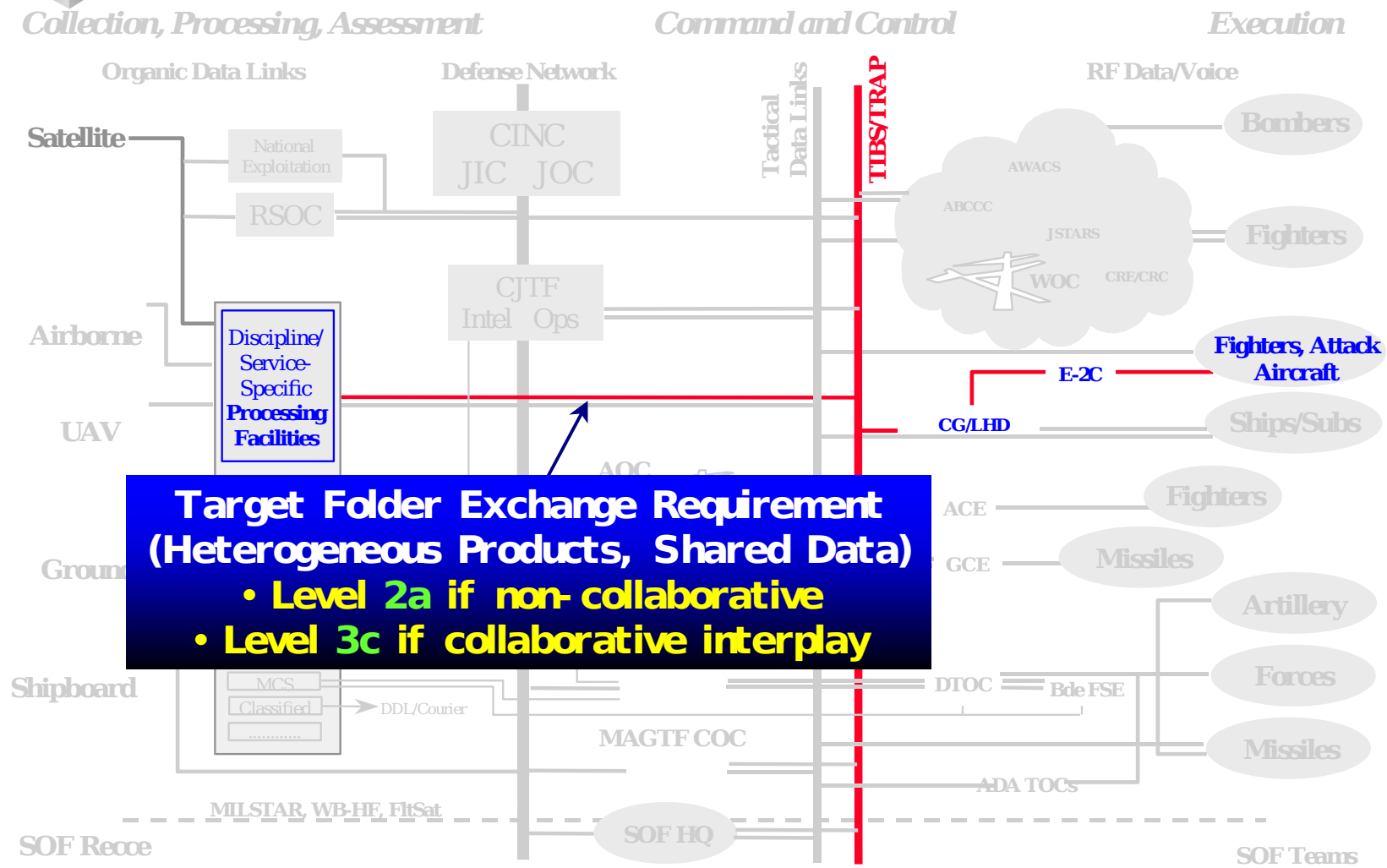
What system capabilities are needed to perform the required level of information exchange?

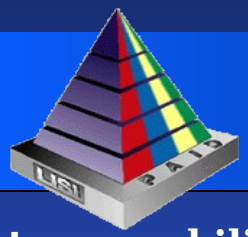
What technical criteria must the capabilities meet?

What levels of information exchanges are required to support mission operations?

The Architecture Framework principles that DoD, IC, & Federal agencies are using incorporate LISI into all three

Use of LISI "Up Front" in the Operational View

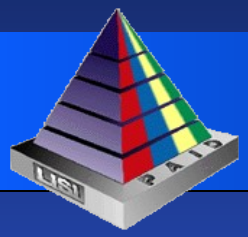




The Integration of LISI and Architectures Helps Determine the Impact of Various Interoperability Levels on Mission Effectiveness

Interoperability Maturity Levels	Enabled Business Process	Impact on Information Quality & Response					Mission Operations Supported
		Content	Format	Precisi	Time	Security	Targeting
4 Application Sharing & COP Manipulation	Collab-orative	Event-responsive information; scaleable perspectives; common data & shared apps across domains	Adaptive, event-driven & scaleable views	Event-focused, correlated & collaborated; de-confliction across domains	Minutes or Seconds	Fully automated cross-domain	•Re-locatable, mobile, & moving targets •Dynamic priorities •Essential Assisted Target Recognition (ATR)
3 Database Sharing & Sophisticated Collaboration		User-adapted information; interactive cueing and filtering; shared data across organizations; full cut-and-paste	Adaptive, user-tailored views	Event-driven, correlated & collaborated; de-confliction across COIs		Fully automated cross-COI	•Re-locatable & mobile targets •Stable priorities •Some ATR
2 Complex Exchange & Basic Collaboration	Co-operative	Mostly pre-set, multi-media products; automated cut-and-paste; some interactive filtering	Fixed multi-media views; user choices	Precision based on all-source fusion; limited de-confliction across organizations	Hours or Minutes	Firewalls Guards PKI	•No *a priori* intelligence •Some challenging priorities •No ATR •Limited *a priori* intelligence
1 Simple Exchange		Pre-set, single-medium products; limited capability to filter products; user extraction	Fixed, non-integrated views	Individual source-driven; non-correlated; high risk of conflicts	Weeks or Days	Man in the loop	•Fixed targets •Stable priorities •No ATR
0 Manual	Isolated	Pre-set, single-medium products; user extraction o needed					•No *a priori*

Relationships
to Other Constructs



Comparison with Other Maturity Models

Reference Model	Primary Thrust	Scope
IC IS Capability Maturity Roadmap DII COE Levels of Runtime Environment Compliance Levels of Information Systems Interoperability (LISI) NATO Levels of System Interconnection CIA Community of Interest (COI) Security Levels	Functional Capability	***Intelligence Community*** • Levels of Enterprise IT capability maturity • Information technology & functional capabilit
	Applications Portability	• ***DoD*** • Levels of application-to-workstation/OS portability • Segmentation, configuration control, documentation, ...
	Systems Interopera-bility	***Global*** • Levels of information-exchange sophisticatio • IS implementations (procedures, applications infrastructure, and data
	Access Control	• ***NATO member countries*** • Levels of system access • Users, systems, & connectivity/access contro
	Data Protection	***CIA*** • Levels of COI security and data protection • System/network security, access authority, protection methods

LISI "Maps" Current Interoperability Rule Sets to the Levels

JTA
COE
NATO
OSI

IC
Roadmap
MISSI
SSI
DMS
....

Current Guidance

Consistency & Reality Checks

LISI Level

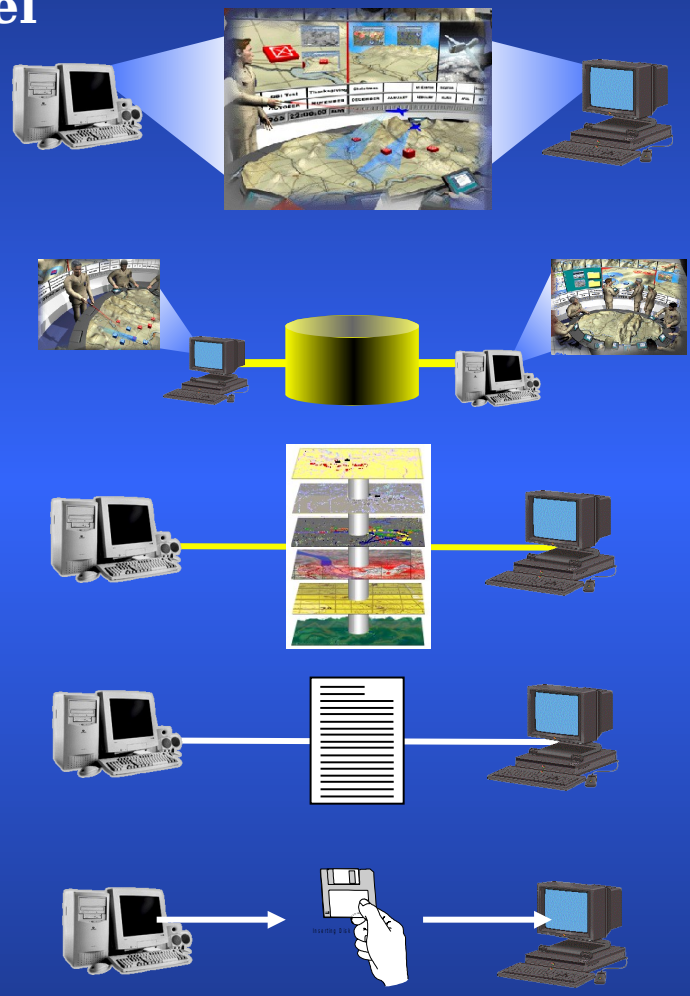
4

3

2

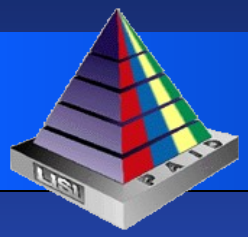
1

0



What aspects and elements of each guidance document are related to achieving the desired level of interoperability?

The Tool
Inspector



What is *Inspecto*

- A ***web-based interactive survey administration tool*** that facilitates the registration of current and planned system capabilities and implementations
- A ***multi-disciplined system profiling and assessment capability*** that examines and compares systems in context with *LISI* and any pre-defined reference model or construct
- A ***flexible analysis and report-generation capability*** that enables analysis results to be presented in a variety of perspectives and contexts
- A tool that ***facilitates its own evolution and extensions*** based on user inputs and proposed modifications

What Does *Inspector* Provide to the User?

- Ability to ***develop and manage user-defined questionnaires*** on any subject
- Ability to ***extend the data collection range, function, or purpose of a questionnaire*** without additional software development
- Ability to ***add new questions "at-will".*** Data entered into any specific survey (***e.g., LISI***) can automatically be mapped into the other surveys (e.g., ***DII COE, OSI***).
- Ability to ***import & export data as comma-delimited text files*** (can be sent using standard Email programs)
- Ability to ***generate reports that describe single systems and that compare multiple systems*** against any user-defined reference models included within the tool.

Our Analysis Capability & Tool have Expanded Considerably Since First Focus on LISI

Profiled Data

Inspector

IC IT Capability Roadmap

COI Levels

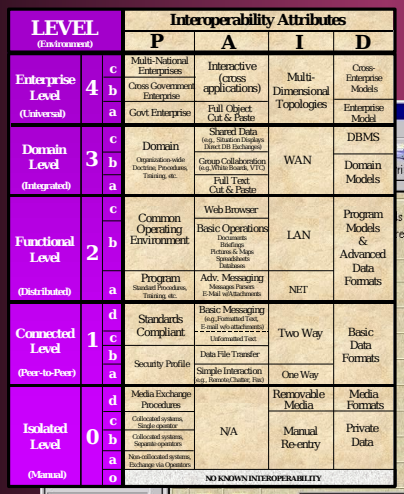
Other Reference Models

DII COE V4.0

MARCOR MSTAR

OSI Reference Model

LISI



LEVEL (Environment)			Interoperability Attributes P	A	I	D
Enterprise Level (Universal)	4	c	Multi-National Enterprises	Interactive (cross applications)	Multi-Dimensional Topologies	Cross-Enterprise Models
		b	Cross Government Enterprise			
		a	Govt. Enterprise	Full Object Cut & Paste		Enterprise Model
Domain Level (Integrated)	3	c	Domain	Shared Data	WAN	DBMS
		b		Group Collaboration		Domain Models
		a		Full Text Cut & Paste		
Functional Level (Distributed)	2	c	Common Operating Environment	Web Browser	LAN	Program Models & Advanced Data Formats
		b		Basic Operations		
		a	Program	Adv. Messaging	NET	
Connected Level (Peer-to-Peer)	1	d	Standards Compliant	Basic Messaging	Two Way	Basic Data Formats
		c				
		b	Security Profile	Data File Transfer		
		a		Simple Interaction	One Way	
Isolated Level (Manual)	0	d	Media Exchange Procedures	N/A	Removable Media	Media Formats
		c			Manual Re-entry	Private Data
		b				
		a				
		o	NO KNOWN INTEROPERABILITY			

Attributes: Procedures, Applications, Infrastructure, Data

Categories: Information Assurance, Communications, Doctrine, Hardware, Management, Messaging Services, Operations, Security, Software, Requirements

[AVFmt] **Audio/Video Data Formats**: What *audio and video* data formats can be read or written?

	Read	Write	Format	Description	Standard
1.	☐	☐	.au	Audio Sound File	
2.	☐	☐	JPEG 2000	JPEG 2000	
3.	☐	☐	.mov	Video (Movie)	
4.	☐	☐	MPEG 1	Motion Pictures Experts Group (CD ROM)	JTA 2.2.2.1.4.6
5.	☐	☐	MPEG 2	Motion Pictures Experts Group (HDTV)	JTA 2.2.2.1.4.6
6.	☐	☐	.qt	QuickTime File Format	
7.	☐	☐	RecVoice	Recorded voice	
8.	☐	☐	.wav	Wave Sound File	

	Description
	Hyper Text Markup Language
	Standard Graphics Markup Language
	eXtended Markup Language
	VR Markup Language
	Microsoft ActiveX
	Java Applets
	Dynamic Java
	Java Script Language

9. ☐ ☐ Other

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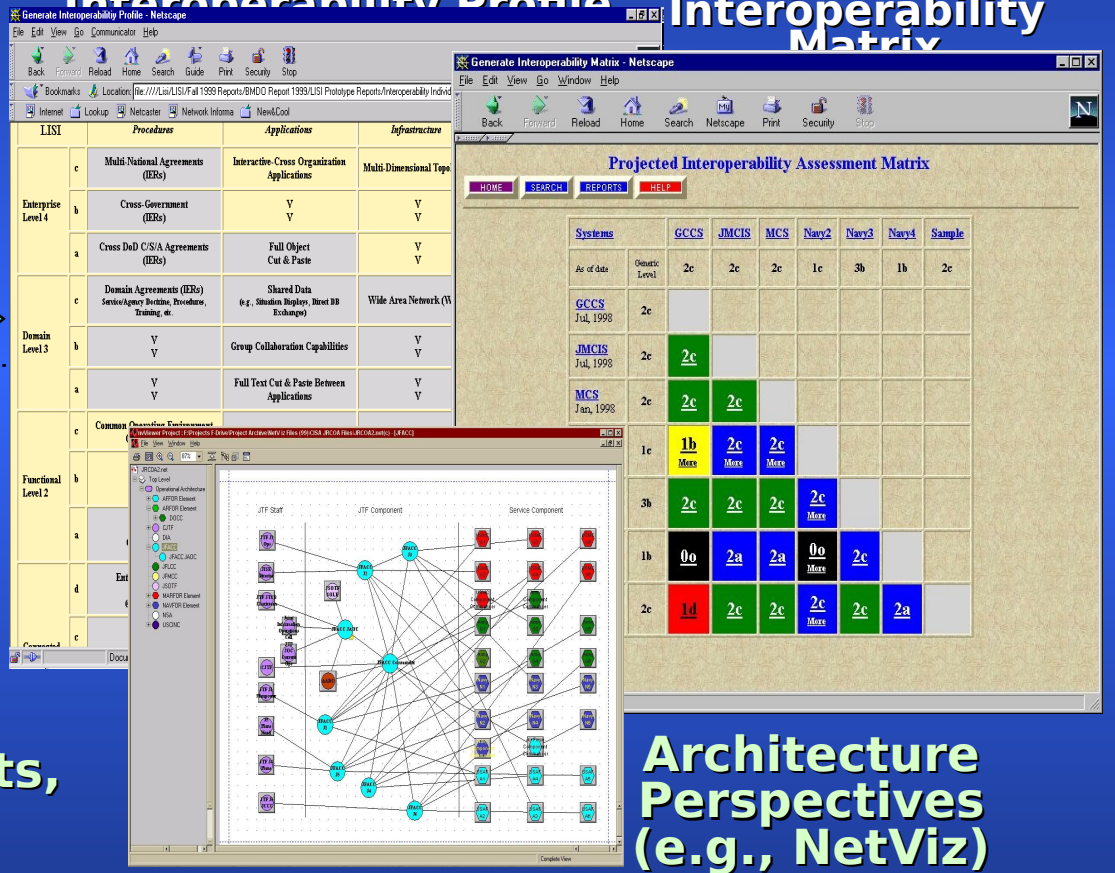
Inspector Capabilities

ystem Survey Questionnaire

Variety of Assessments & Reports

System Interoperability Profile

System² Interoperability Matrix

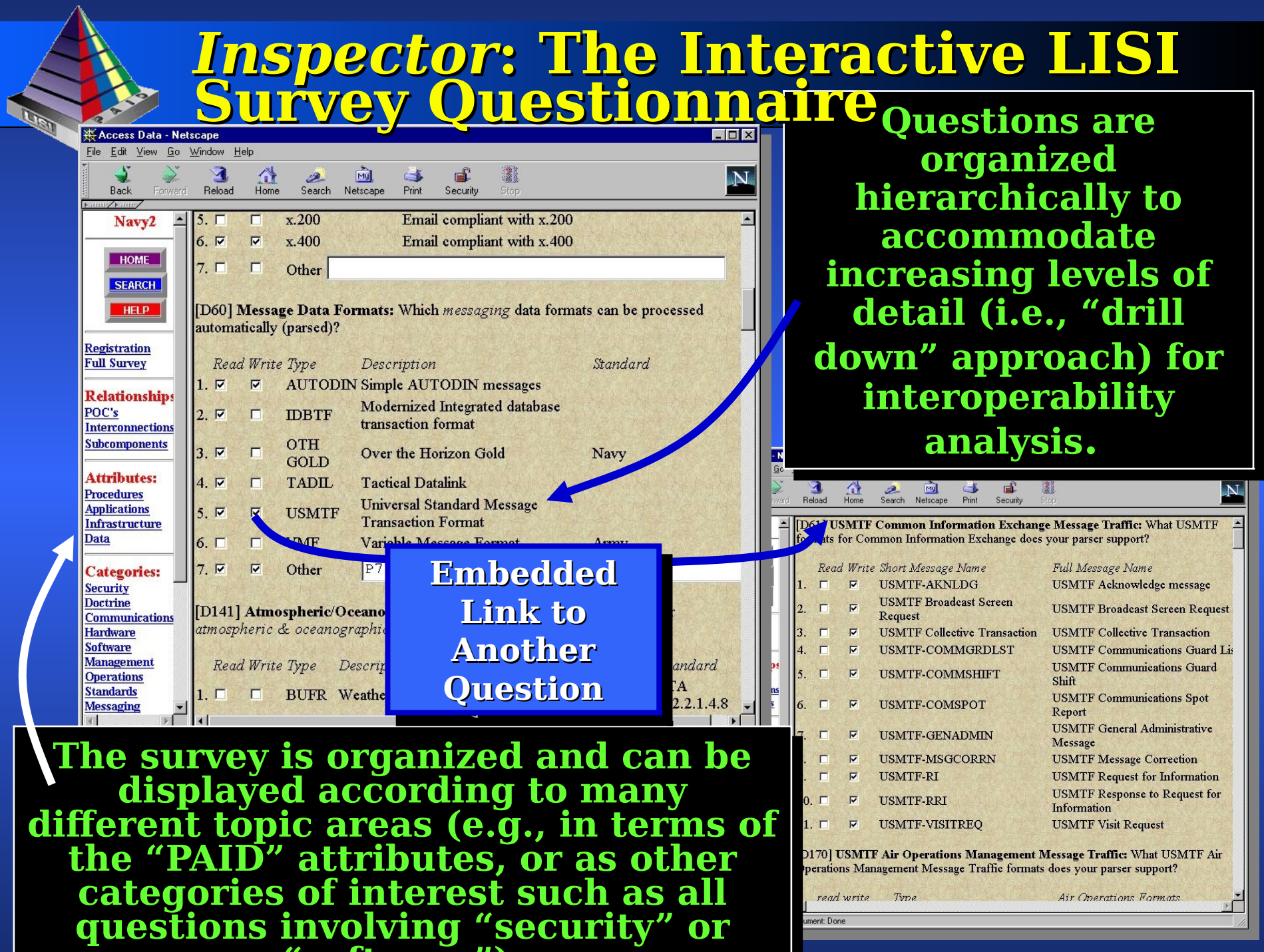


OSI-Based Reports,
DII COE I&RTS Reports,
MSTAR Reports, ...

Architecture Perspectives (e.g., NetViz)

Inspector **features a Web-based questionnaire that captures system capabilities and implementations identified by the PMs and generates LISI-, OSI-, DII COE-, & MSTAR-based assessments**

Inspector: The Interactive LISI Survey Questionnaire

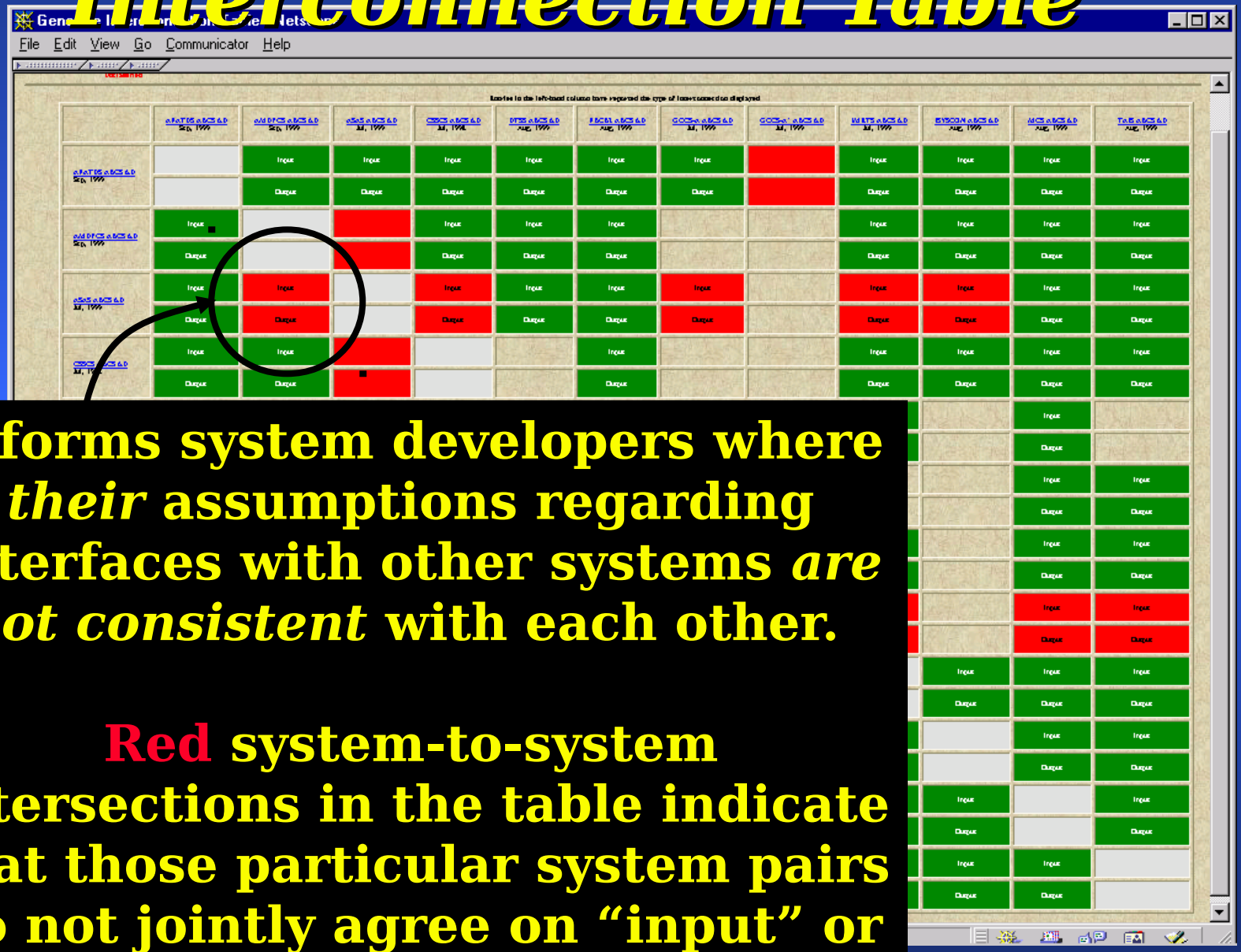

Access Data - Netscape
File Edit View Go Window Help
Back Forward Reload Home Search Netscape Print Security Stop
Navy2
HOME
SEARCH
HELP
Registration
Full Survey
Relationships
POC's
Interconnections
Subcomponents
Attributes:
Procedures
Applications
Infrastructure
Data
Categories:
Security
Doctrine
Communications
Hardware
Software
Management
Operations
Standards
Messaging
5. x.200 Email compliant with x.200
6. x.400 Email compliant with x.400
7. Other
[D60] Message Data Formats: Which messaging data formats can be processed automatically (parsed)?
Read Write Type Description Standard
1. AUTODIN Simple AUTODIN messages
2. IDBTF Modernized Integrated database transaction format
3. OTH GOLD Over the Horizon Gold Navy
4. TADIL Tactical Datalink
5. USMTF Universal Standard Message Transaction Format
7. Other
[D141] Atmospheric/Oceano
atmospheric & oceanographi
Read Write Type
1. BUFR
Reload Home Search Netscape Print Security
[D61] USMTF Common Information Exchange Message Traffic: What USMTF formats for Common Information Exchange does your parser support?
Read Write Short Message Name Full Message Name
1. USMTF-AKNLDG USMTF Acknowledge message
2. USMTF Broadcast Screen Request USMTF Broadcast Screen Request
3. USMTF Collective Transaction USMTF Collective Transaction
4. USMTF-COMMGRDLST USMTF Communications Guard List
5. USMTF-COMMSHIFT USMTF Communications Guard Shift
6. USMTF-COMSPOT USMTF Communications Spot Report
7. USMTF-GENADMIN USMTF General Administrative Message
USMTF-MSGCORRN USMTF Message Correction
USMTF-RI USMTF Request for Information
0. USMTF-RRI USMTF Response to Request for Information
1. USMTF-VISITREQ USMTF Visit Request
[D170] USMTF Air Operations Management Message Traffic: What USMTF Air Operations Management Message Traffic formats does your parser support?
read write Type Air Operations Formats
Document: Done

Questions are organized hierarchically to accommodate increasing levels of detail (i.e., "drill down" approach) for interoperability analysis.

Embedded Link to Another Question

The survey is organized and can be displayed according to many different topic areas (e.g., in terms of the "PAID" attributes, or as other categories of interest such as all questions involving "security" or

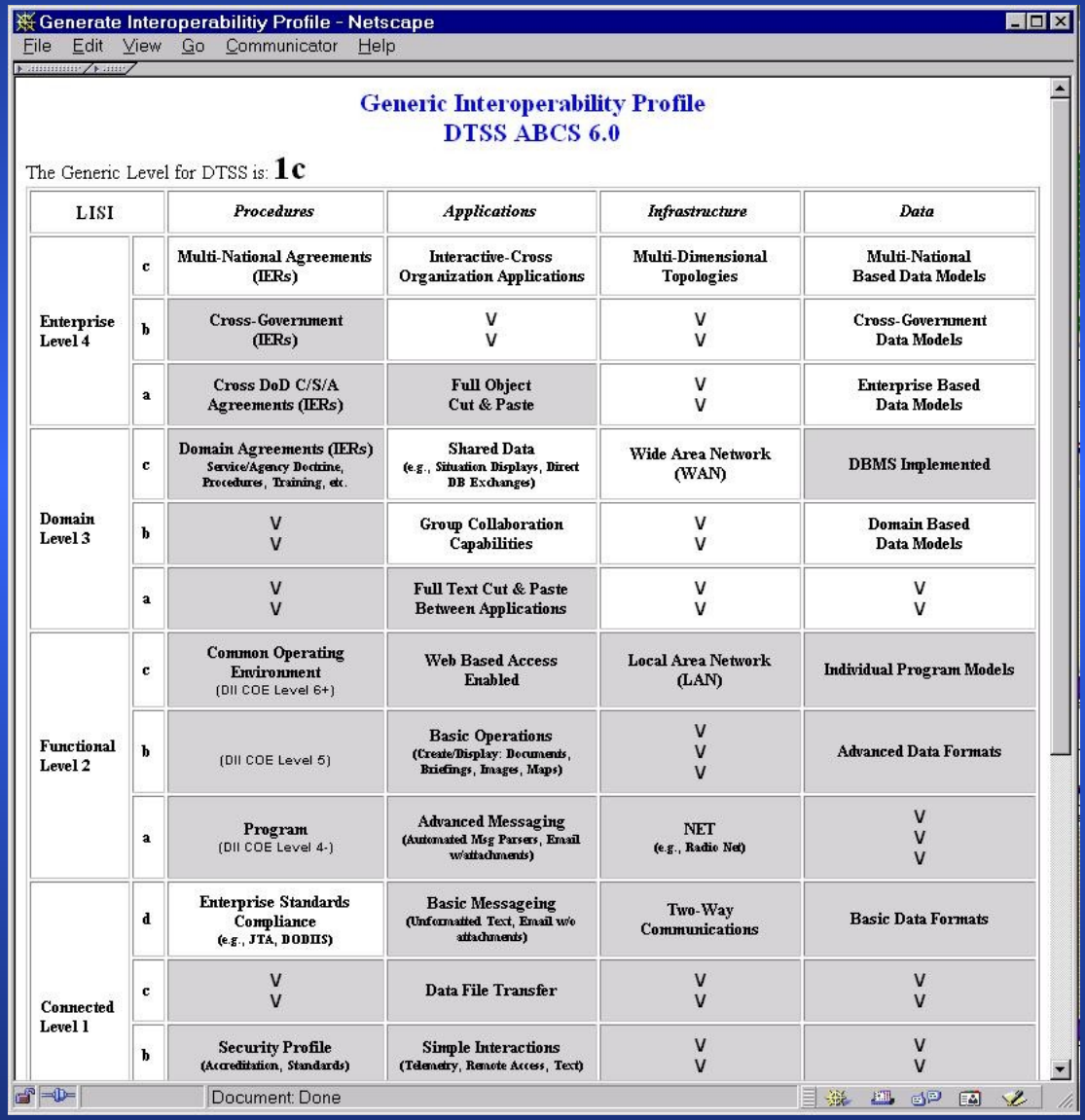
Example: *Interconnection Table*



Informs system developers where *their* assumptions regarding interfaces with other systems *are not consistent* with each other.

Red system-to-system intersections in the table indicate that those particular system pairs do not jointly agree on “input” or

Single System Profile - Abbreviated



Generate Interoperabilitiy Profile - Netscape

File Edit View Go Communicator Help

Generic Interoperability Profile
DTSS ABCS 6.0

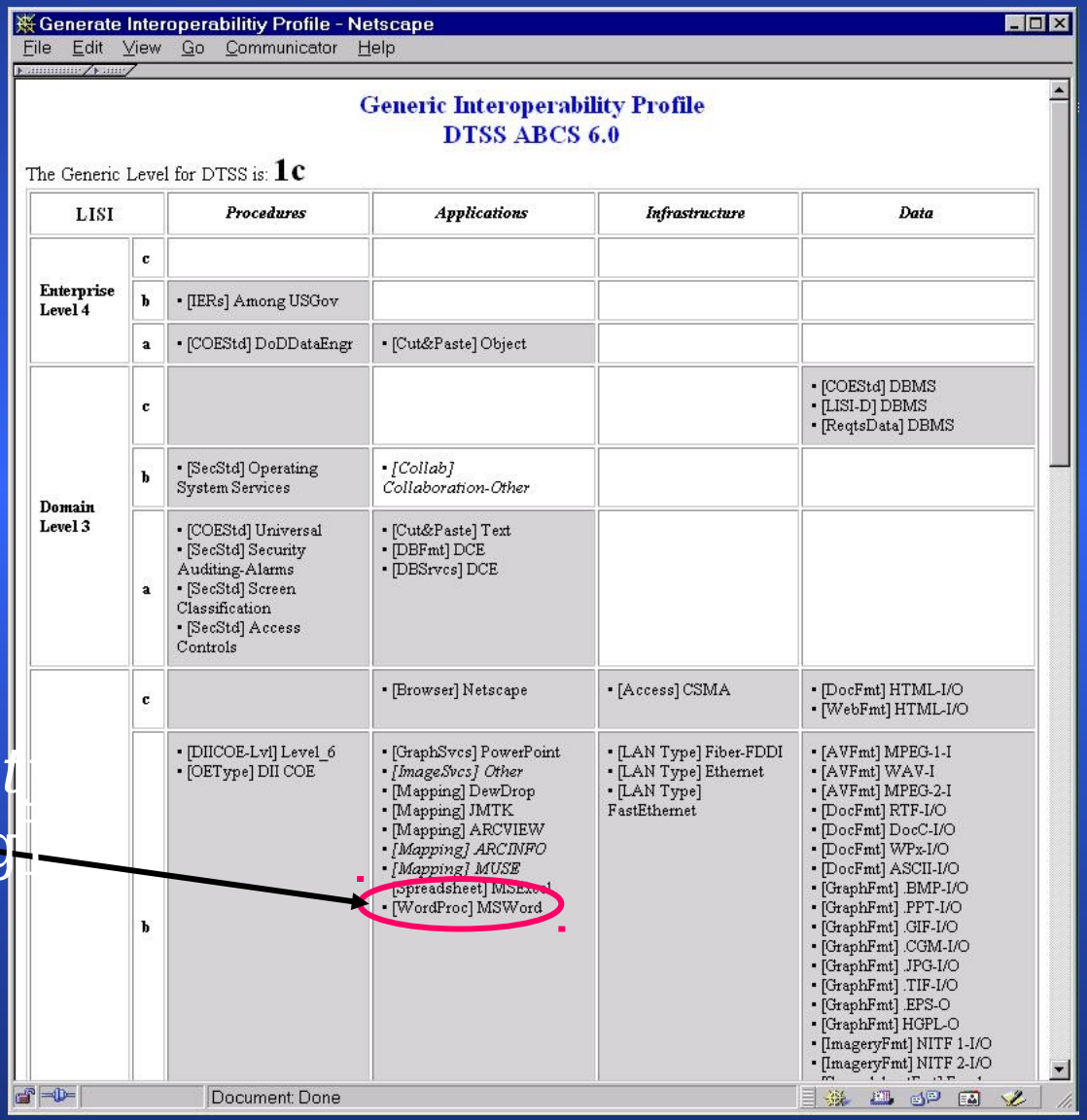
The Generic Level for DTSS is: **1c**

LISI		*Procedures*	*Applications*	*Infrastructure*	*Data*
Enterprise Level 4	c	Multi-National Agreements (IERs)	Interactive-Cross Organization Applications	Multi-Dimensional Topologies	Multi-National Based Data Models
	b	Cross-Government (IERs)	V V	V V	Cross-Government Data Models
	a	Cross DoD C/S/A Agreements (IERs)	Full Object Cut & Paste	V V	Enterprise Based Data Models
Domain Level 3	c	Domain Agreements (IERs) Service/Agency Doctrine, Procedures, Training, etc.	Shared Data (e.g., Situation Displays, Direct DB Exchanges)	Wide Area Network (WAN)	DBMS Implemented
	b	V V	Group Collaboration Capabilities	V V	Domain Based Data Models
	a	V V	Full Text Cut & Paste Between Applications	V V	V V
Functional Level 2	c	Common Operating Environment (DII COE Level 6+)	Web Based Access Enabled	Local Area Network (LAN)	Individual Program Models
	b	(DII COE Level 5)	Basic Operations (Create/Display: Documents, Briefings, Images, Maps)	V V V	Advanced Data Formats
	a	Program (DII COE Level 4-)	Advanced Messaging (Automated Msg Parsers, Email w/attachments)	NET (e.g., Radio Net)	V V V
Connected Level 1	d	Enterprise Standards Compliance (e.g., JTA, DODIIS)	Basic Messageing (Unformatted Text, Email w/o attachments)	Two-Way Communications	Basic Data Formats
	c	V V	Data File Transfer	V V	V V
	b	Security Profile (Accreditation, Standards)	Simple Interactions (Telemetry, Remote Access, Text)	V V	V V

Document: Done

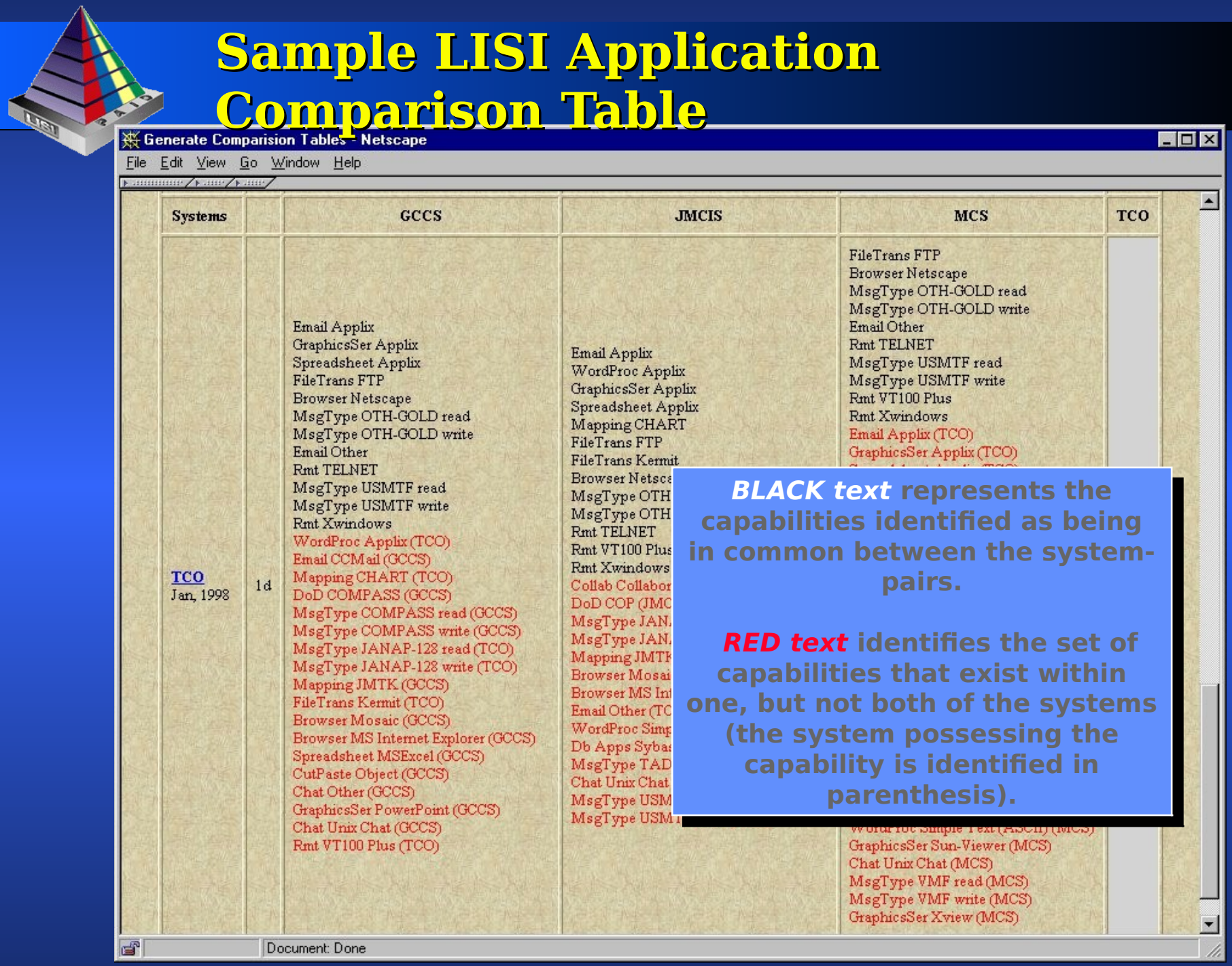
Single System Profile - Extended

Example Capabilit
[Word Processing
MS Word

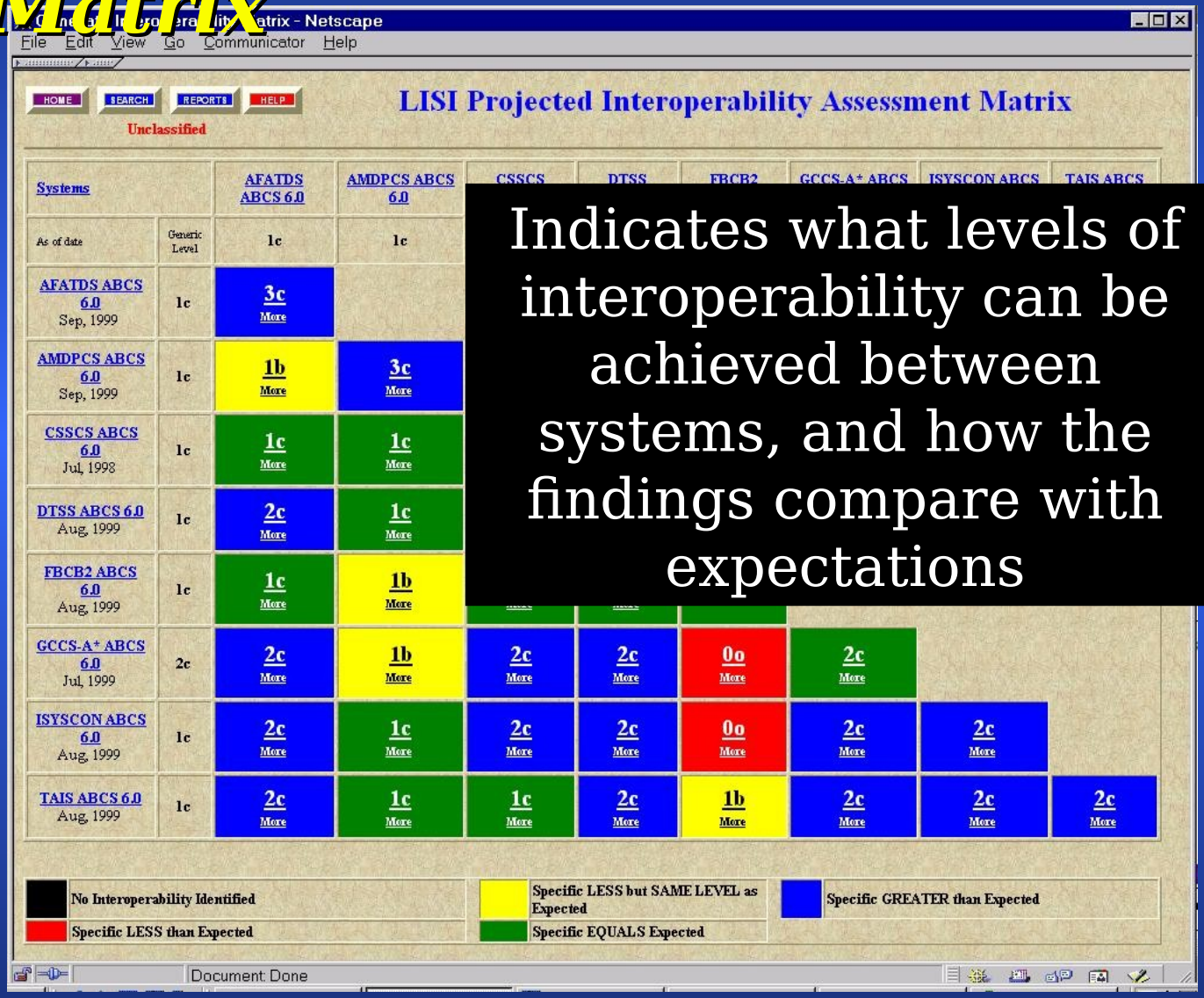

Generate Interoperabilitiy Profile - Netscape
File Edit View Go Communicator Help
Generic Interoperability Profile
DTSS ABCS 6.0
The Generic Level for DTSS is: 1c
Document: Done

LISI		Procedures	Applications	Infrastructure	Data
Enterprise Level 4	c				
	b	• [IERs] Among USGov			
	a	• [COEStd] DoDDataEngr	• [Cut&Paste] Object		
Domain Level 3	c				• [COEStd] DBMS • [LISI-D] DBMS • [ReqtsData] DBMS
	b	• [SecStd] Operating System Services	• *[Collab] Collaboration-Other*		
	a	• [COEStd] Universal • [SecStd] Security Auditing-Alarms • [SecStd] Screen Classification • [SecStd] Access Controls	• [Cut&Paste] Text • [DBFmt] DCE • [DBSrvcs] DCE		
	c		• [Browser] Netscape	• [Access] CSMA	• [DocFmt] HTML-I/O • [WebFmt] HTML-I/O
	b	• [DIICOE-Lvl] Level_6 • [OEType] DII COE	• [GraphSvcs] PowerPoint • *[ImageSvcs] Other* • [Mapping] DewDrop • [Mapping] JMTK • [Mapping] ARCVIEW • *[Mapping] ARCINFO* • *[Mapping] MUSE* • [Spreadsheet] MSExcel • [WordProc] MSWord	• [LAN Type] Fiber-FDDI • [LAN Type] Ethernet • [LAN Type] FastEthernet	• [AVFmt] MPEG-1-I • [AVFmt] WAV-I • [AVFmt] MPEG-2-I • [DocFmt] RTF-I/O • [DocFmt] DocC-I/O • [DocFmt] WPx-I/O • [DocFmt] ASCII-I/O • [GraphFmt] .BMP-I/O • [GraphFmt] .PPT-I/O • [GraphFmt] .GIF-I/O • [GraphFmt] .CGM-I/O • [GraphFmt] .JPG-I/O • [GraphFmt] .TIF-I/O • [GraphFmt] .EPS-O • [GraphFmt] HGPL-O • [ImageryFmt] NITF 1-I/O • [ImageryFmt] NITF 2-I/O

Sample LISI Application Comparison Table



Example: *Interoperability Assessment Matrix*


Netscape
File Edit View Go Communicator Help
HOME SEARCH REPORTS HELP
Unclassified
LISI Projected Interoperability Assessment Matrix
Systems
AFATDS ABCS 6.0
AMDPCS ABCS 6.0
CSSCS
DTSS
FBCB2
GCCS-A* ABCS
ISYSCON ABCS
TAIS ABCS
As of date
Generic Level
1c
1c
AFATDS ABCS 6.0 Sep, 1999 | 1c | 3c More
AMDPCS ABCS 6.0 Sep, 1999 | 1c | 1b More | 3c More
CSSCS ABCS 6.0 Jul, 1998 | 1c | 1c More | 1c More
DTSS ABCS 6.0 Aug, 1999 | 1c | 2c More | 1c More
FBCB2 ABCS 6.0 Aug, 1999 | 1c | 1c More | 1b More
GCCS-A* ABCS 6.0 Jul, 1999 | 2c | 2c More | 1b More | 2c More | 2c More | 0o More | 2c More
ISYSCON ABCS 6.0 Aug, 1999 | 1c | 2c More | 1c More | 2c More | 2c More | 0o More | 2c More | 2c More
TAIS ABCS 6.0 Aug, 1999 | 1c | 2c More | 1c More | 1c More | 2c More | 1b More | 2c More | 2c More | 2c More
No Interoperability Identified
Specific LESS but SAME LEVEL as Expected
Specific GREATER than Expected
Specific LESS than Expected
Specific EQUALS Expected
Document: Done

Indicates what levels of interoperability can be achieved between systems, and how the findings compare with expectations

What's New ?

- **Systems Database**
  - 120+ USCG systems (300 new options)
  - 18 JIIB systems
  - 5-8 USMC systems
- **Survey Structures**
  - JIIB Category (new questions wrt MIDB, GCCS)
  - Web Services questions
  - Joint Variable Message Format (74 JVMF questions)
- **New Tool Features**
  - **General Improvements**
    - More emphasis on accuracy & reliability than new features
    - Search Screen improvements
  - **Question/Survey Module**
    - Print Survey function pop-up windows
      - E-mail delivery method
    - Radio-button de-select option
  - **Reports Module**
    - Standard/Group Comparison Report
    - System Survey Comparison Report
    - Standards Profile and Conformance Reports
  - **Survey Administration Module**
    - Enhanced color coding in Question Builder
    - Admin access to Survey Builders' Reports
  - **Import/Export Enhancements**

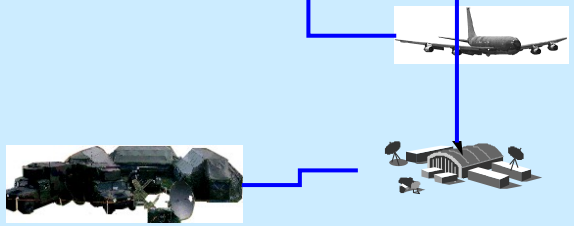
How does
Inspector relate
to other tools?

"Interoperability" Tool Relationships Overview

InterPRO
JCAPS
MSTAR
NAD
RAD
...

Information Exchange

Operations Centric

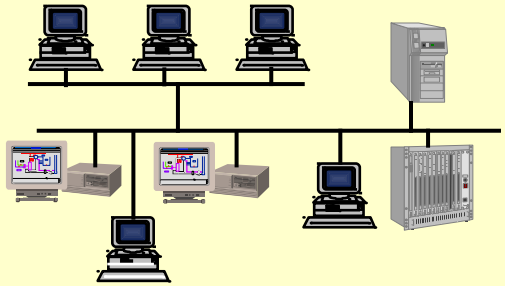


System capabilities needed to support information exchange

Inspector (LISI)
JOTID
...

System Capabilities

System Centric

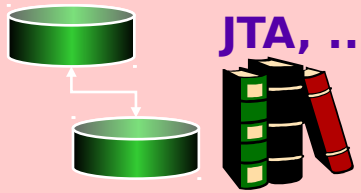


Compatibility and rules compliance of system implementations

TULIP
DART
ERWIN
...

Implementation Compatibility, Compliance, & Engineering

Data Centric



We have proposed a MOIE initiative to interface InterPro & DART with Inspector

Improving the "tool suite" for CIPO

Exploring Synergism Opportunities

- DART (GRCI) LISI and DART teams conducted joint
  each tool to assess the potential of
  d DART to extend "message"
  ties for DoD

GRC INTERNATIONAL INC

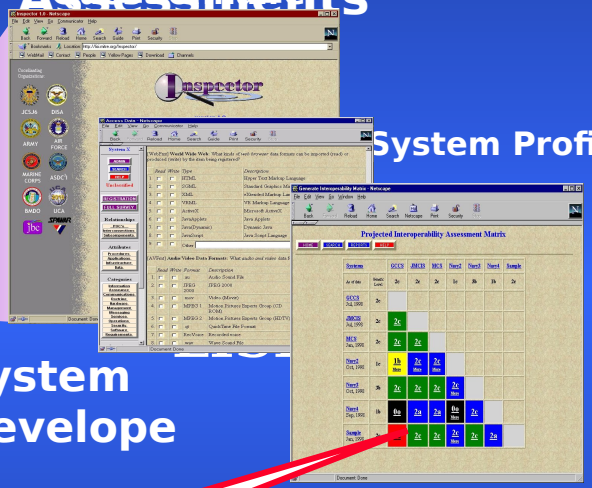
- Project Rainbow (LMCO) LISI and Rainbow teams held discussions and joint demonstrations conducted.
  of using LISI to provide system
  nent Rainbow Interoperability
  s

LOCKHEED MARTIN

Potential Relationships -- DART and Inspector

Inspector Tool-Facilitates System Registration & Capabilities Interoperability Assessments

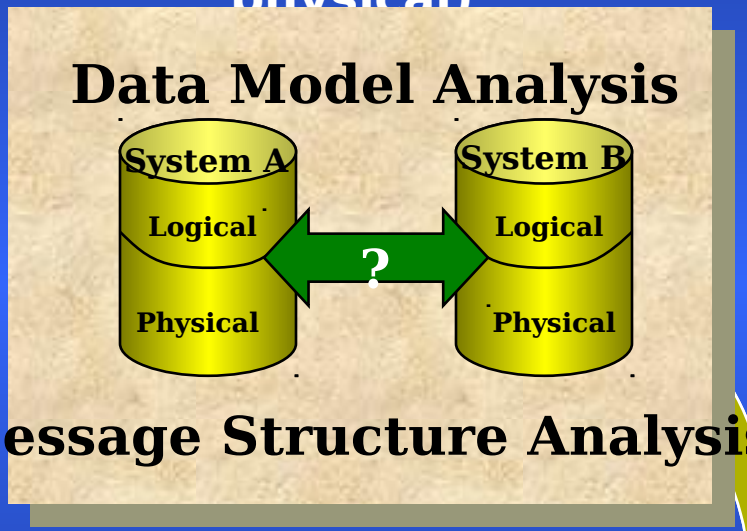
DART Tool-Facilitates Detailed Assessments of Data Structure Interoperability (logical & physical)



System Developers

Shortfall

Levels Achievable Between Systems



LISI

PM/Developer Entered System Technical Profiles

SYSTEM PROFILES

DATA STRUCTURE RESULTS

DART

Results of Database and Message Structure

We Submitted A MOIE Proposal to Pilot a Scheme to Integrate Inspector with Complementary Tools

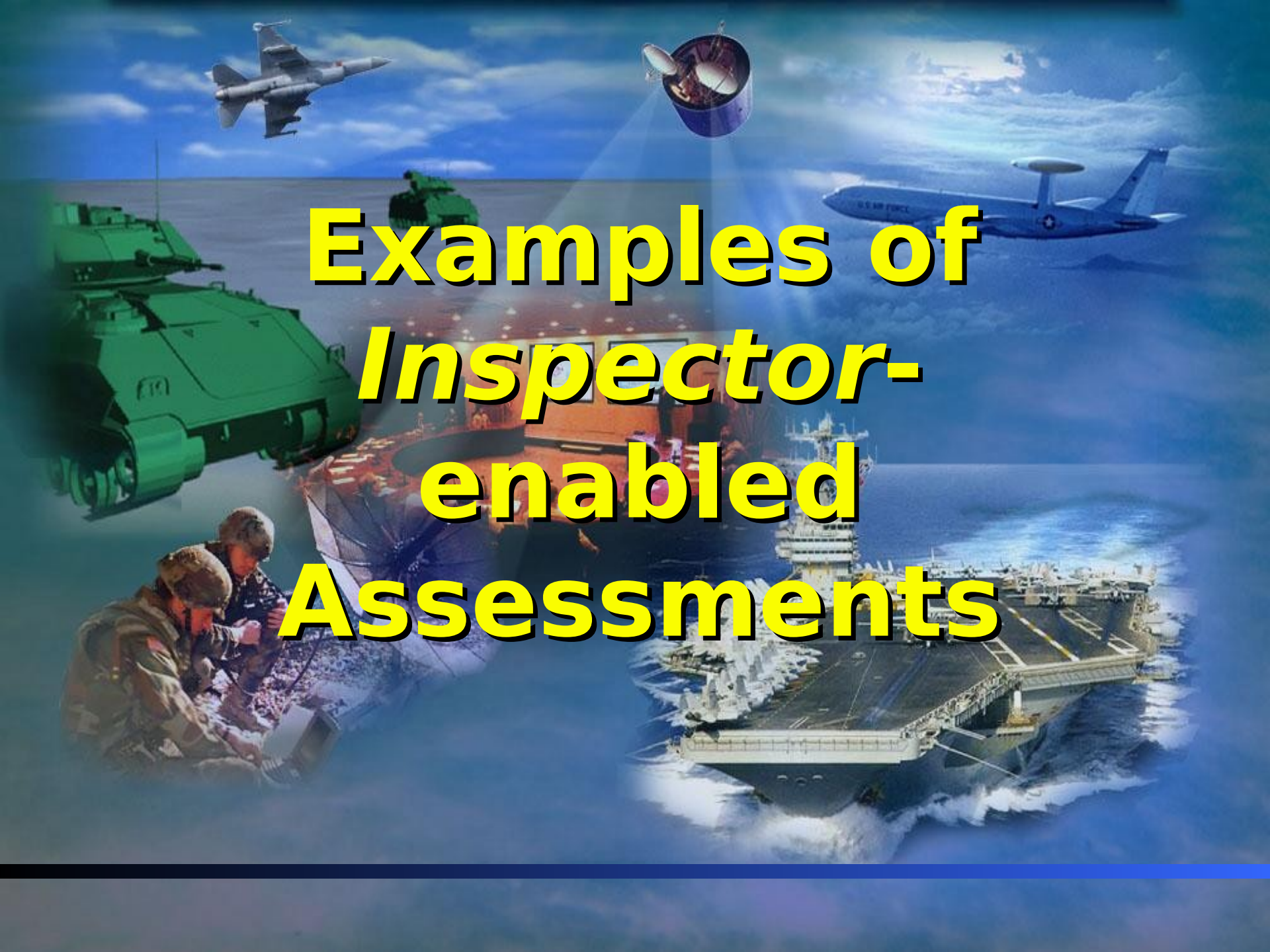
G074/G066 MSR/MOIE PROPOSAL ABSTRACT

Project Title Interoperability Tools Integration	Date 24 April 2002
Principal Investigator (PI) Carl Richard, G074	Technology Integrator (TI) Dan Helm, G066
Technology Area Architecture & Decision Support	Technology Area Team (TAT) Leader Rick Tucker (Architecture) and Emily Beaton (Decision Support)
Proposed Start Date 1 October 2002	Proposed Project Duration 12 Months
Technical Staff Years Proposed (FY03) 2 Staff Years	Budget Proposed (FY03) $400K
Technical Staff Years Proposed (follow on years) 0.5 Staff Years for FY 04	Budget Proposed (follow on years) $100K for FY 04

MITRE/G074's ***Inspector*** tool focuses on *system-to-system* interoperability. Some tools, such as ***InterPro***, focus on *operational requirements* and associated IERs. Other tools, such as ***DART***, focus on certain *technical dimensions* of interoperability such as data structures and schema. These particular tools are *logically* complimentary, but cannot be executed as an integrated tool suite without significant human interaction.

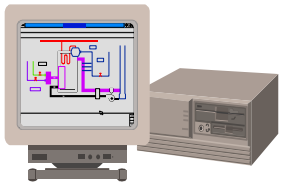
MOIE OBJECTIVE. The objective of this MOIE initiative is to develop a pilot framework that will enable the data from individual but complementary interoperability assessment tools to be "combined" with *Inspector* to create a virtual capability that leverages and integrates the strengths of each tool.

MOIE APPROACH. To be effective and acceptable across a range of user domains, interoperability data and analysis tools must be integrated in a way that accepts behavioral and stylistic differences in how programs approach and evaluate interoperability. The MOIE investigation approach is based on advancing

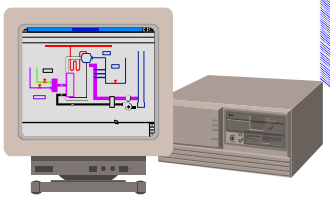

Examples of
Inspector-
enabled
Assessments

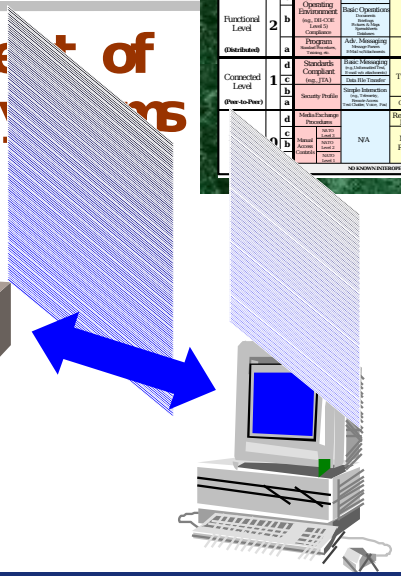
Types of LISI Assessments

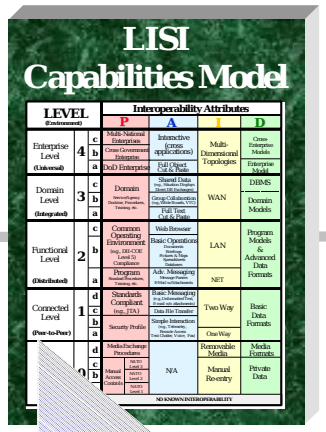
LISI Assessment of a Single System



LISI Assessment of Two or More Systems







Sufficiency

Are the capabilities for the requisite level present across PAID?

Conformance

Are the existing capabilities compliant with the criteria that govern Enterprise implementations?

Sufficiency

Are the requisite PAID capabilities in both systems?

Interoperability

Are the existing capabilities interoperable with each other? (e.g., common products, common standards compliance, ..)

MITRE

COMPASS

COMPASS System Interoperability Profile - Sep 97

COMPASS Attributes

LISI Capabilities Model

LEVEL			Interoperability Attributes			
			P	A	I	D
Enterprise	4	c				
		b				
		a				
Domain	3	c		ShowMe NV/VAT	IP WAN Video Camera	
		b				DIS PDUs
		a		Cut & Paste	IP Multicast	
Functional	2	c	COE Level 5	Gap	TCP/IP	
		b				VAT audio NV video
		a		Solaris Operating System	Ethernet	COMPASS Messages
Connected	1	d				Map Formats
		c				
		b	Non-Standards Compliance	X Windows		JFIF Images
		a				
Isolated	0	d				
		c				
		b				
		a				
		o	NO KNOWN INTEROPERABILITY			

Maturing the COMPASS Capability

Level 2c achievable if Web interface provided

Level 2b achievable if standards-compliance issue is resolved

Current Level is limited to 1b due to non-standard implementations

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PATRIOT-AEGIS

LISI Interoperability Assessment Matrix

Systems		AEGIS 5.3B BL 5 Phase 3B	AEGIS 6.3 BL 6 Phase 3	PATRIOT 2.4 Config 2 PDB 4
As of date	Generic Level	2a	2a	2a
AEGIS 5.3B BL 5 Phase 3B Aug, 1999	2a	2a	3b	
AEGIS 6.3 BL 6 Phase 3 Aug, 1999	2a	2a		
PATRIOT 2.4 Config 2 PDB 4 Aug, 1999	2a	2a	2a	2a
PATRIOT 3.5 Config 3 PDB 5 Aug, 1999	2a	2a	2a	3c

PATRIOT & AEGIS each program made significant *internal* upgrades

- Domain-level data models
- More applications (e.g., mapping, web browser)
- WAN access

But

AEGIS 5.3B ↔ 2a ↔ PATRIOT 2.4

AEGIS 6.3 ↔ 2a ↔ PATRIOT 3.5

No Change !

Each program made *different implementation choices* -- thus, there was no real increase in the level of sophistication at which PATRIOT and AEGIS could interact with each other !

Caveats

PM data in LISI was not validated

Findings were system-specific (operational impact was not addressed)

Multiple Systems Assessment - MIS Experiment

"System of Systems" Assessment

Individual System Assessment

JMCIS

CTAPS

TCO

MCS/P

GCCS

Composite Interoperability Profile

LEVEL			Interoperability Attributes P	A	I	D
Enterprise	4	c				
		b				
		a				
Domain	3	c			Common WAN	
		b				
		a		Problems		HTML
			COE			USMTF
Connected	1	d	JTA			
		c		FTP		
		b	Common Classification	X-Window		
		a				
Isolated	0	d	Media Exchange	Floppy Disk		
		c				
		b				
		a				
		o	NO KNOWN INTEROPERABILITY			

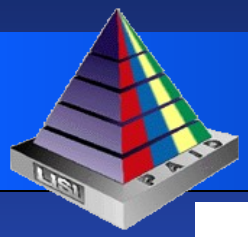
1c

It appears that Level 3 can be achieved by all!

But, Joint systems interoperability above Level 1c is impacted by incompatible

Current JSBA/JIIB Systems Assessment

- **Programmatics**
  - Funding and Oversight: IC CIO
  - Tasking and Direction: Joint Staff, J2P
  - Systems Data Repository: DISA
  - Testing Coordination: JBC
- **MITRE's Role**
  - Use *Inspector* to register & validate 13+ JIIB systems
  - Assess system components
    - All systems versus all systems against LISI levels
    - Architecture need lines related to specific mission operations
- **Provide Testing Configurations and TEMP Thrusts to JBC**
  - Mission operations context (systems configurations and needlines)
  - Expected interoperability outcomes, problems, & quick-fix options
- **Assist JBC during testing process**
- **Prepare report, including improvement strategy**
- **J2P will request IC CIO to continue our support to follow up with Services**



Required Interoperability LISI Assessment Matrix

Systems		ASAS RWS 4.5.1 Oct, 1999	GCCS-I3 (NT) v3.6 Dec, 2002	GCCS-M (UNIX) 3.1.2.1 P1 Mar, 2002	IAS 3.3.x Mar, 2002	IPL 3.0 Mar, 2002	JTT 2.1 Jun, 2002	MIDB 2.0.3.2 Jun, 2001	TBMCS Force Level 1.1 Jun, 2002
As of date	Generic Level	1b	1b	1b	1b	0d	1b	1b	1b
ASAS RWS 4.5.1 Oct, 1999	1b	1b	0o	1b	1b	0d	0o	1b	1b
GCCS-I3 (NT) v3.6 Dec, 2002	1b	0o	2c	2c	2c	0o	0o	0o	2c
GCCS-M (UNIX) 3.1.2.1 P1 Mar, 2002	1b	1b	2c	3c	3c	0d	3c	1b	3c
IAS 3.3.x Mar, 2002	1b	1b	2c	3c	3c	2b	3c	1b	3c
IPL 3.0 Mar, 2002	0d	0d	0o	0d	2b	3c	0o	0d	2b
JTT 2.1 Jun, 2002	1b	0o	0o	3c	3c	0o	3c	0o	3c
MIDB 2.0.3.2 Jun, 2001	1b	1b	0o	1b	1b	0d	0o	1b	1b
TBMCS Force Level 1.1 Jun, 2002	1b	1b	2c	3c	3c	2b	3c	1b	3c

No Interoperability Identified	Specific is LESS than but SAME LEVEL as Expected	Specific is GREATER than Expected
Specific is LESS than Expected	Specific EQUALS Expected	

All cells colored
Full Matrix

UNCLASSIFIED

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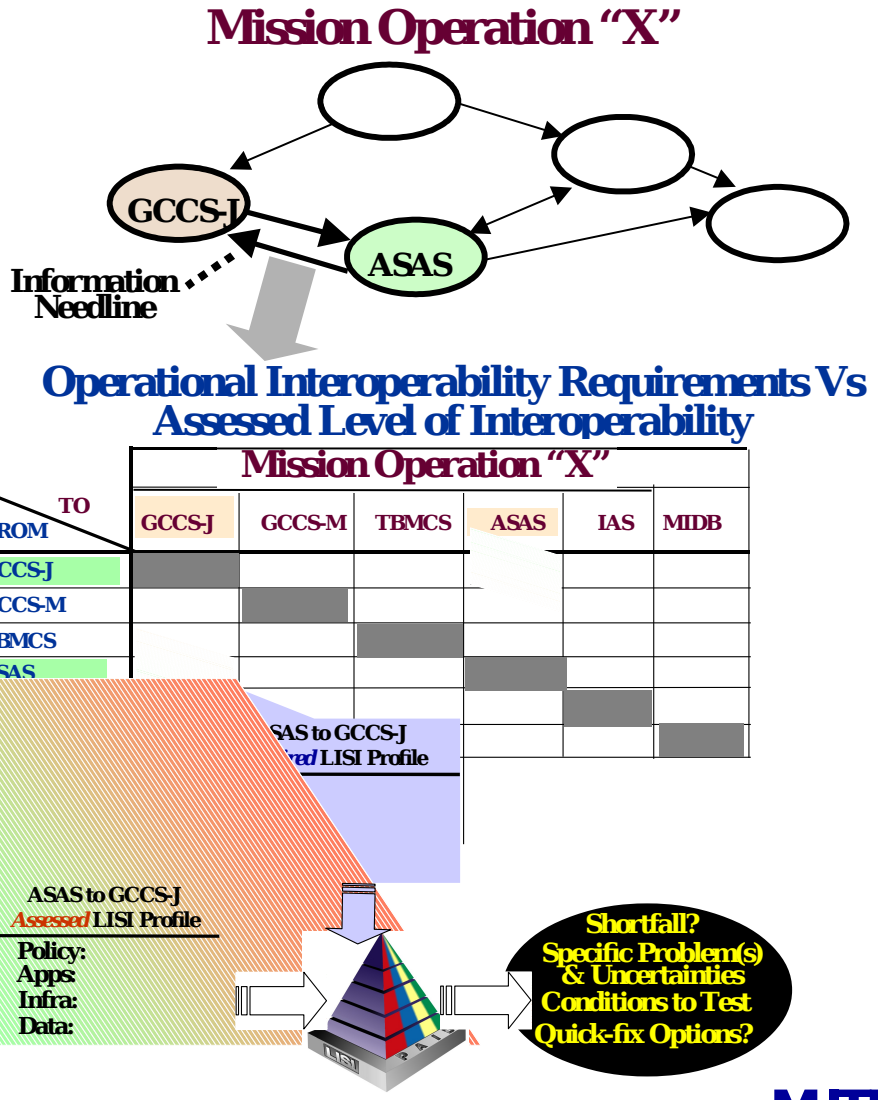
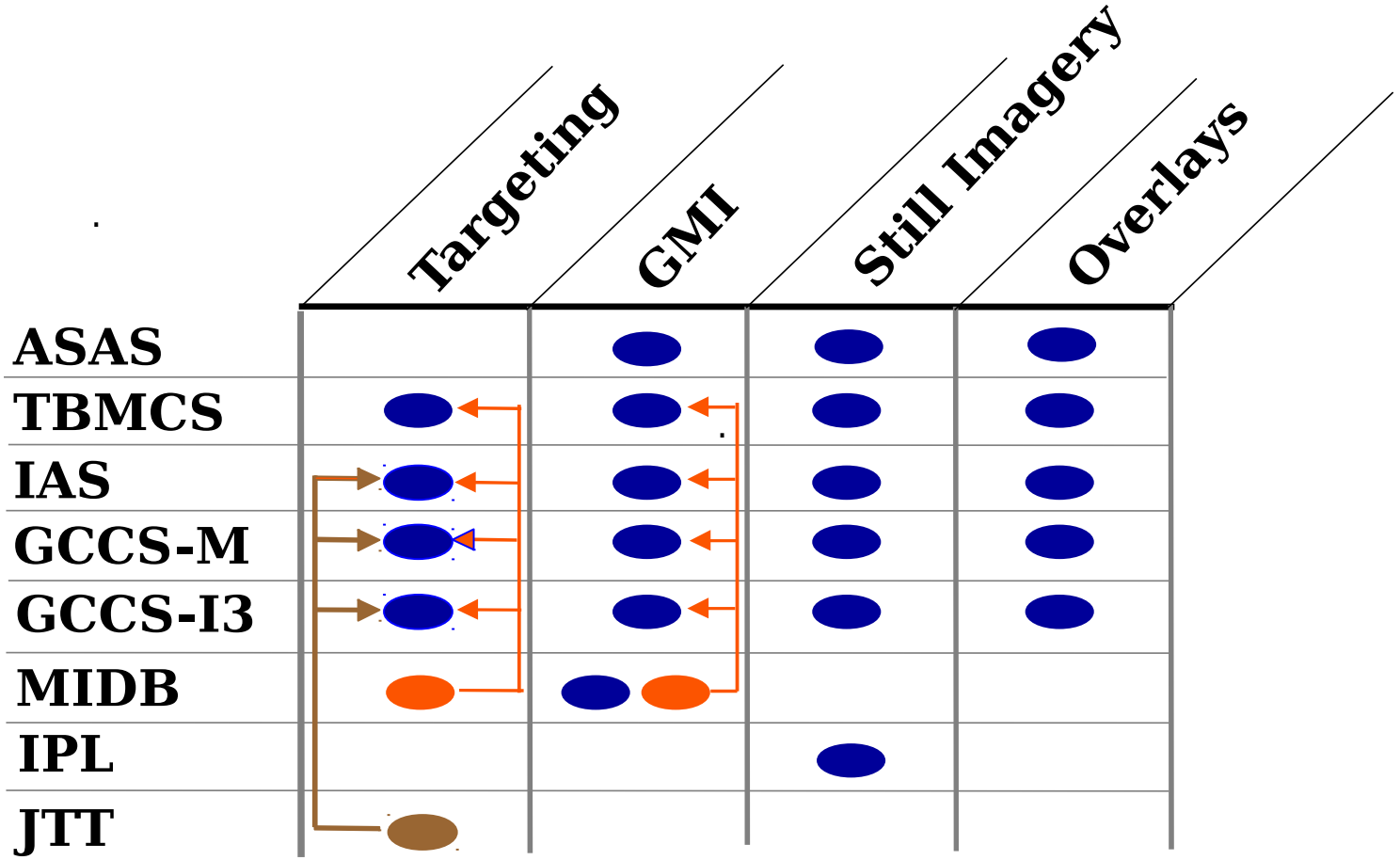
System Components and Mission Operations

- **Mission Operations Suggested by DIA/J 2P**
  - GMI
  - Targeting
  - Images
  - Overlays
- **Systems**
  - IPL 3.0
  - JTT 2.1
  - JDISS Solaris 4.0
  - JDISS Windows 3.3.2
  - IAS 3.3.X
  - ASAS 4.5.1
  - TACLAN
  - GCCS-I3
  - GCCS-M
  - MIDB
  - TBMCS
  - BROADSWORD



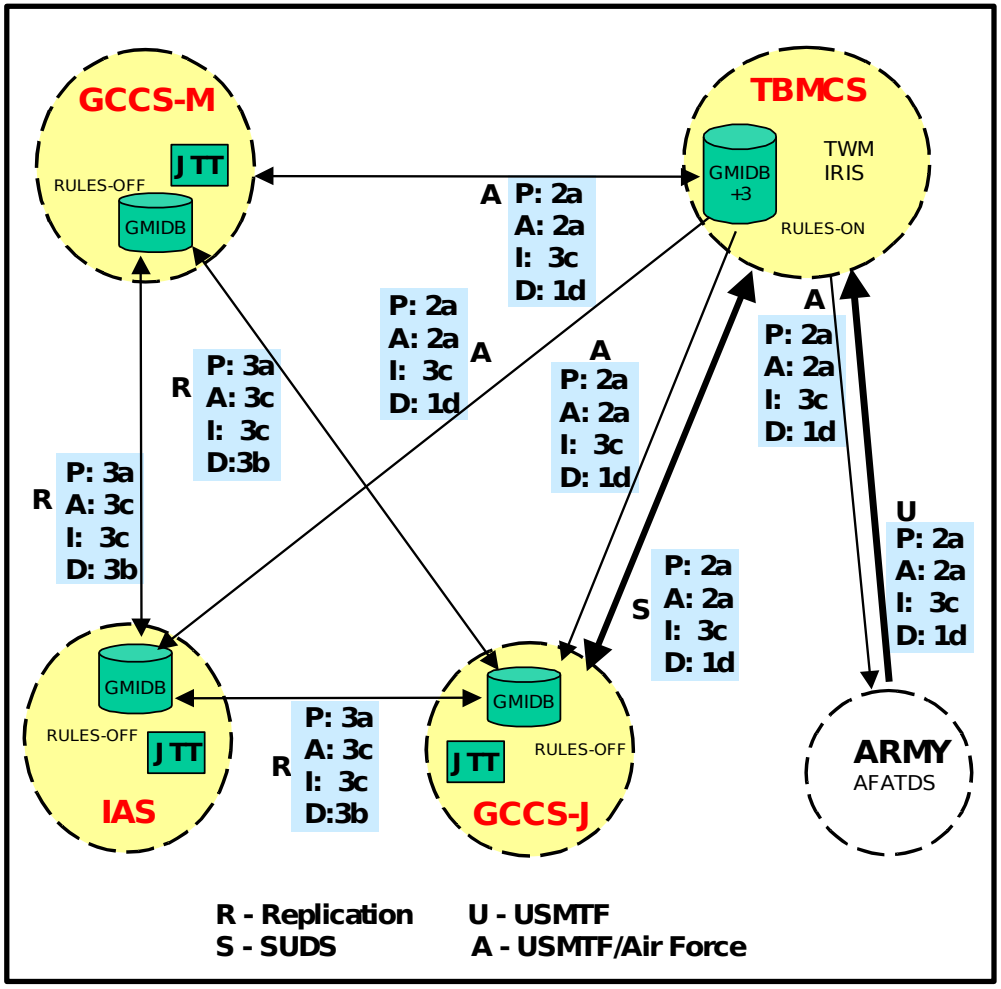
MITRE

Some Components Combine into S
Assessed in Selected Mission Ope



Targeting

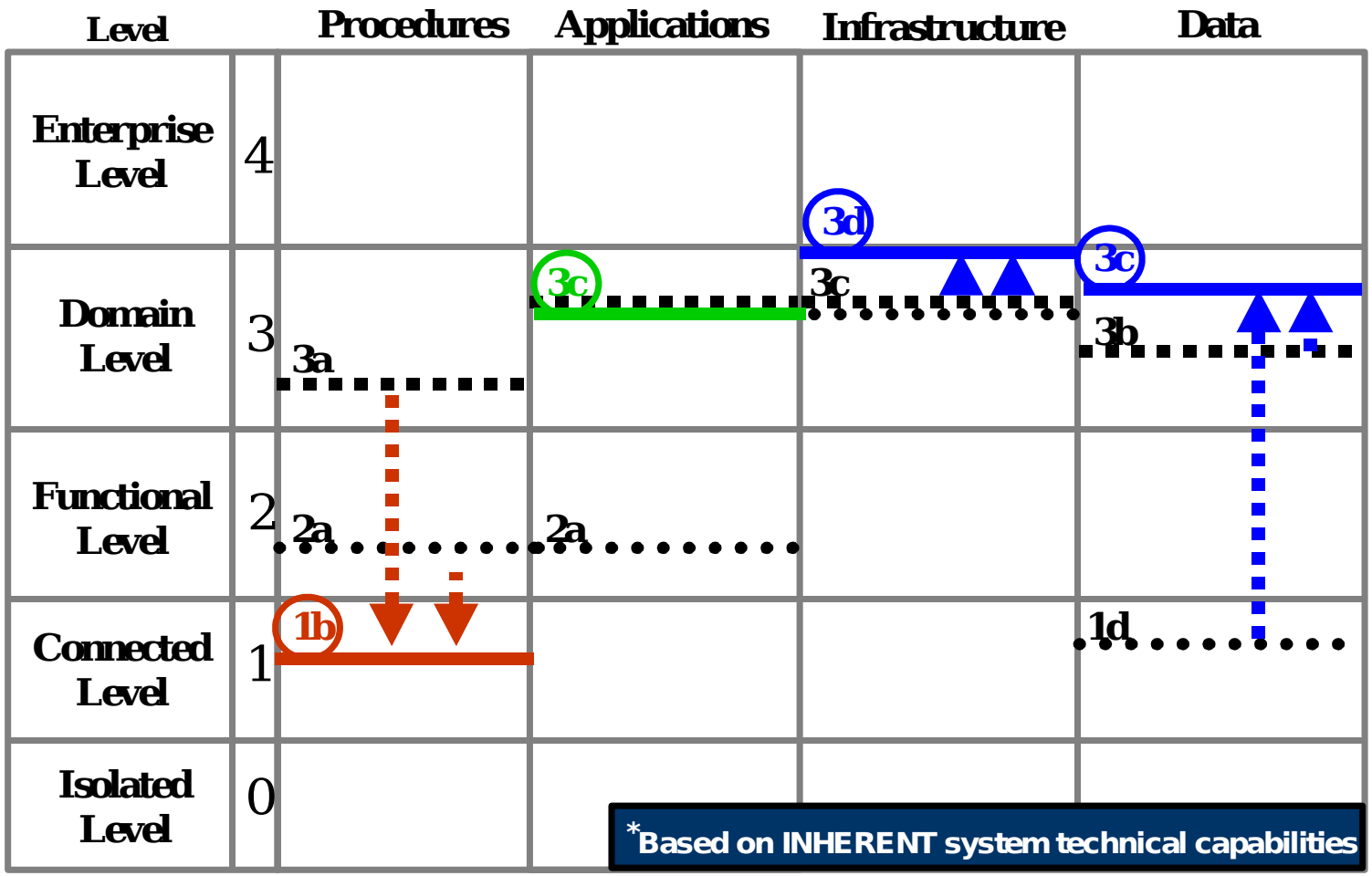
Systems and Need Lines



Interconnection Matrix

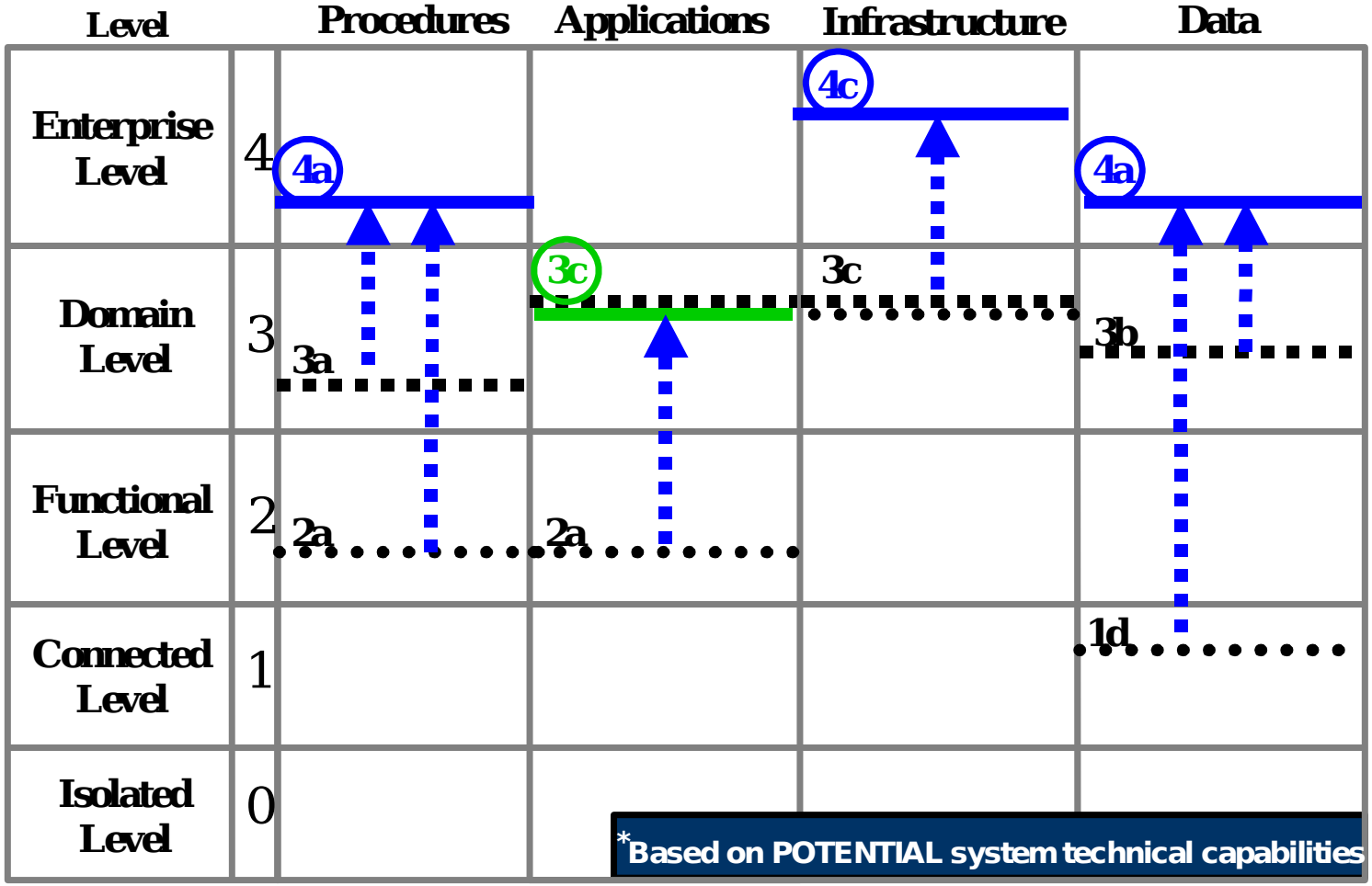
FROM \ TO	GCCS-M	IAS	GCCS-J	TBMCS
GCCS-M		R	R	A
IAS	R		R	
GCCS-J	R	R		S
TBMCS	A	A	A, S	

TARGETING: IAS/GCCS-I3 Assessed Interoperability Profile--Normal* Operational Mode

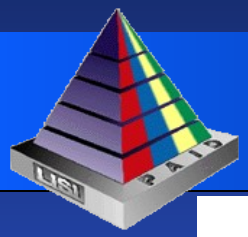


MITRE

TARGETING: GCCS-M/GCCS-I3 Assessed Interoperability Profile--Potential* Operational Mode



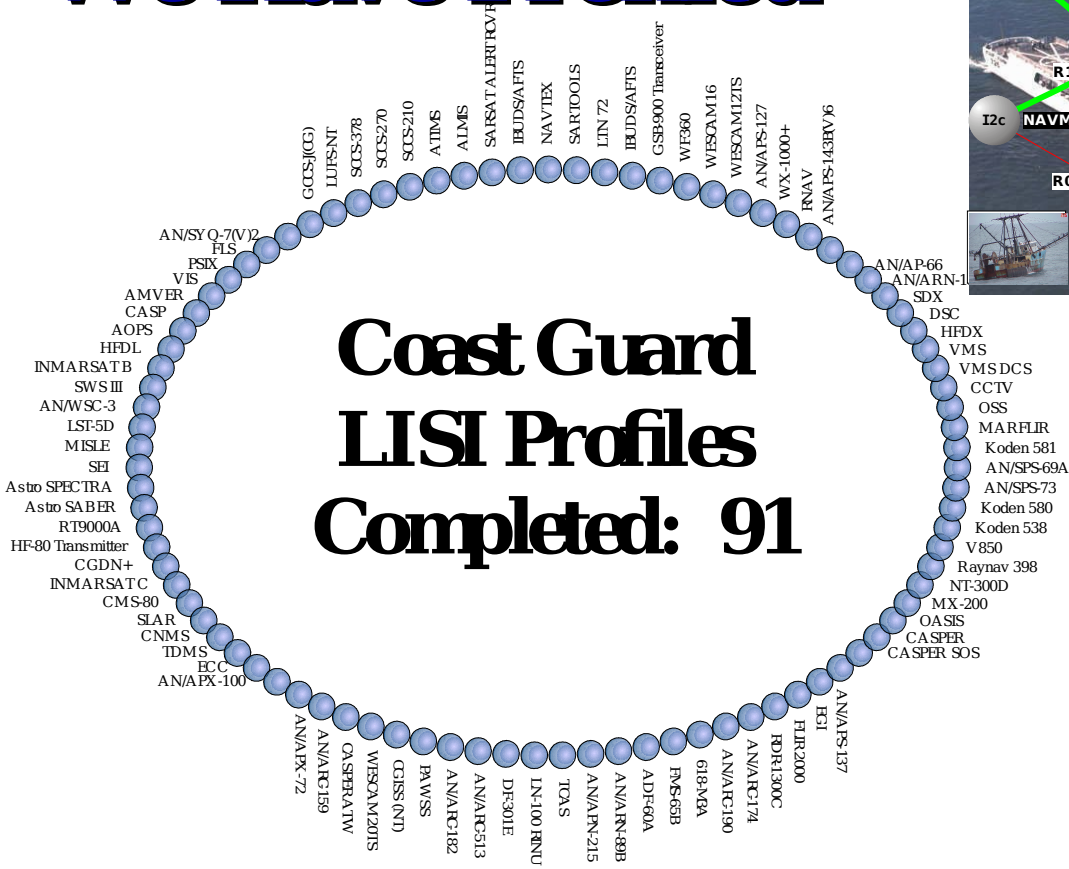
MITRE

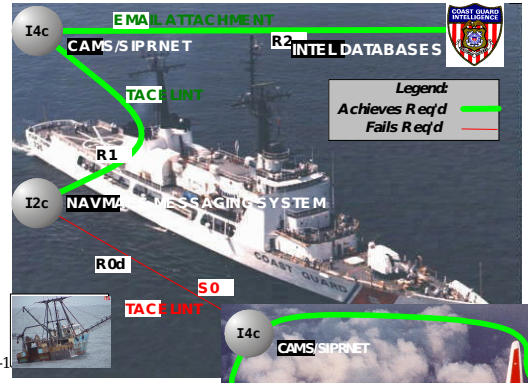


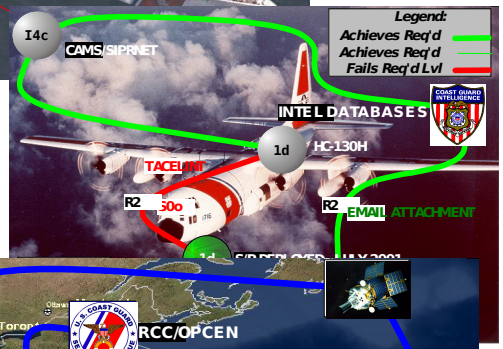
MITRE is Focused on Improving Coast Guard Systems Interoperability

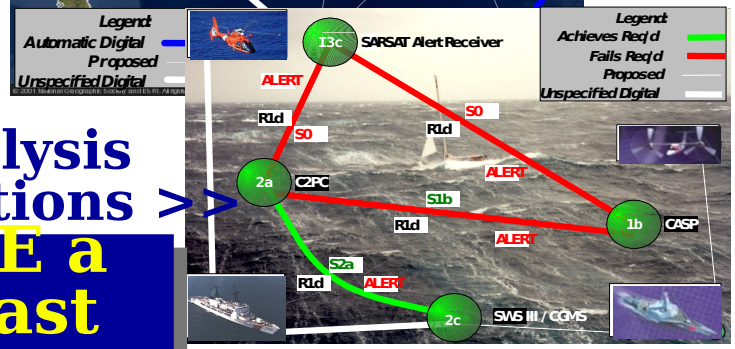
- MITRE is applying its *Levels of Information Systems Interoperability (LISI)* process and tool to Coast Guard systems
  - Profiling the capabilities and implementations of 100+ USCG systems selected by Deepwater in context with the LISI model
  - Assessing the degree to which selected systems can interoperate with each other in context with current and postulated missions and operational requirements
  - Identifying shortfalls and alternative solutions
  - Can use assessments to drive architecture development, system specifications, and investment strategy
- MITRE has also developed a preliminary concept for establishing a USCG test and evaluation process for assuring systems interoperability

Coast Guard Systems We Have Profiled







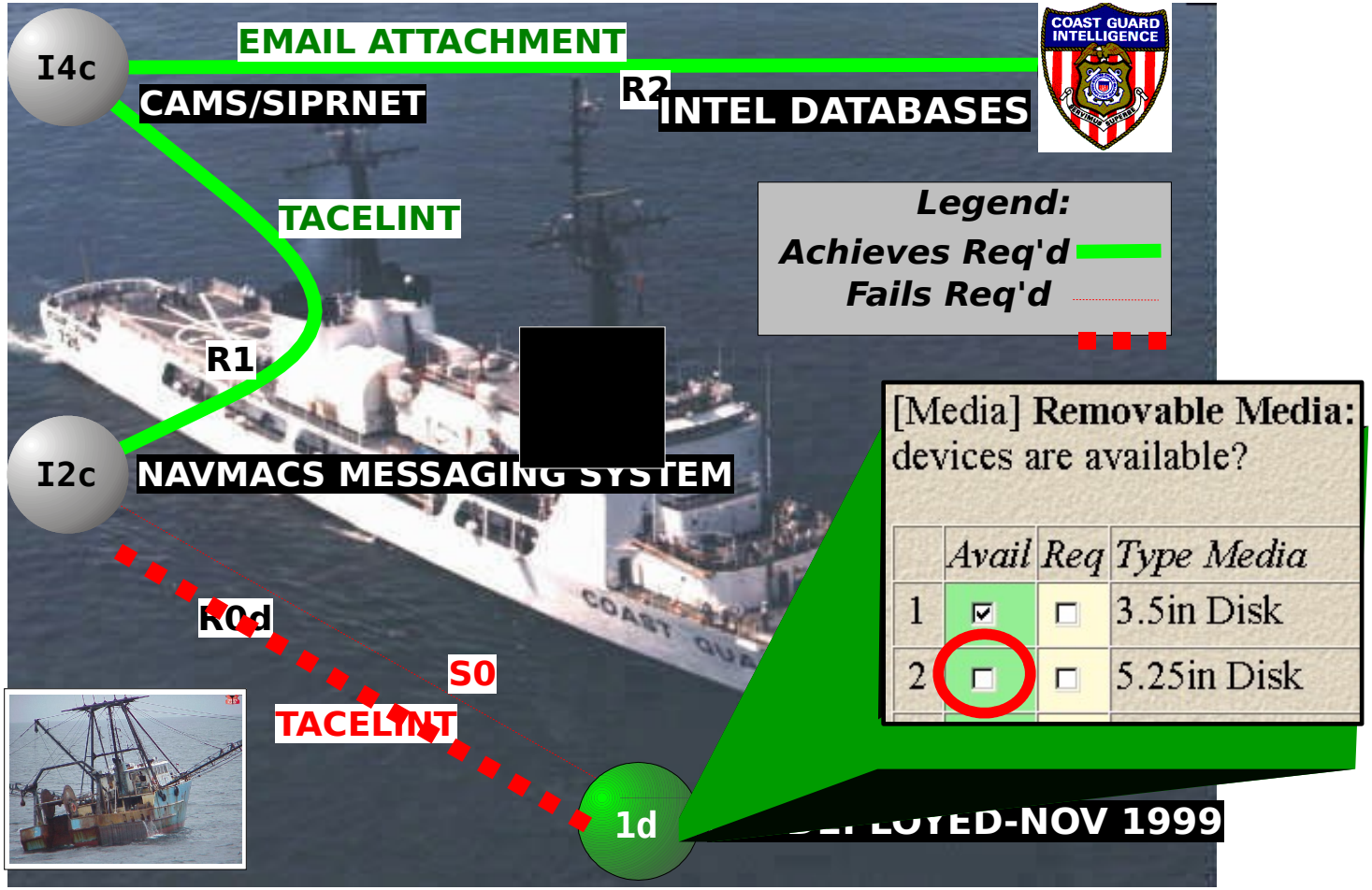


Interoperability Analysis Scenario Demonstrations >>

USCG recently awarded MITRE a $1.4M contract to develop Coast Guard's Enterprise Architecture driven by LISI assessments

MITRE

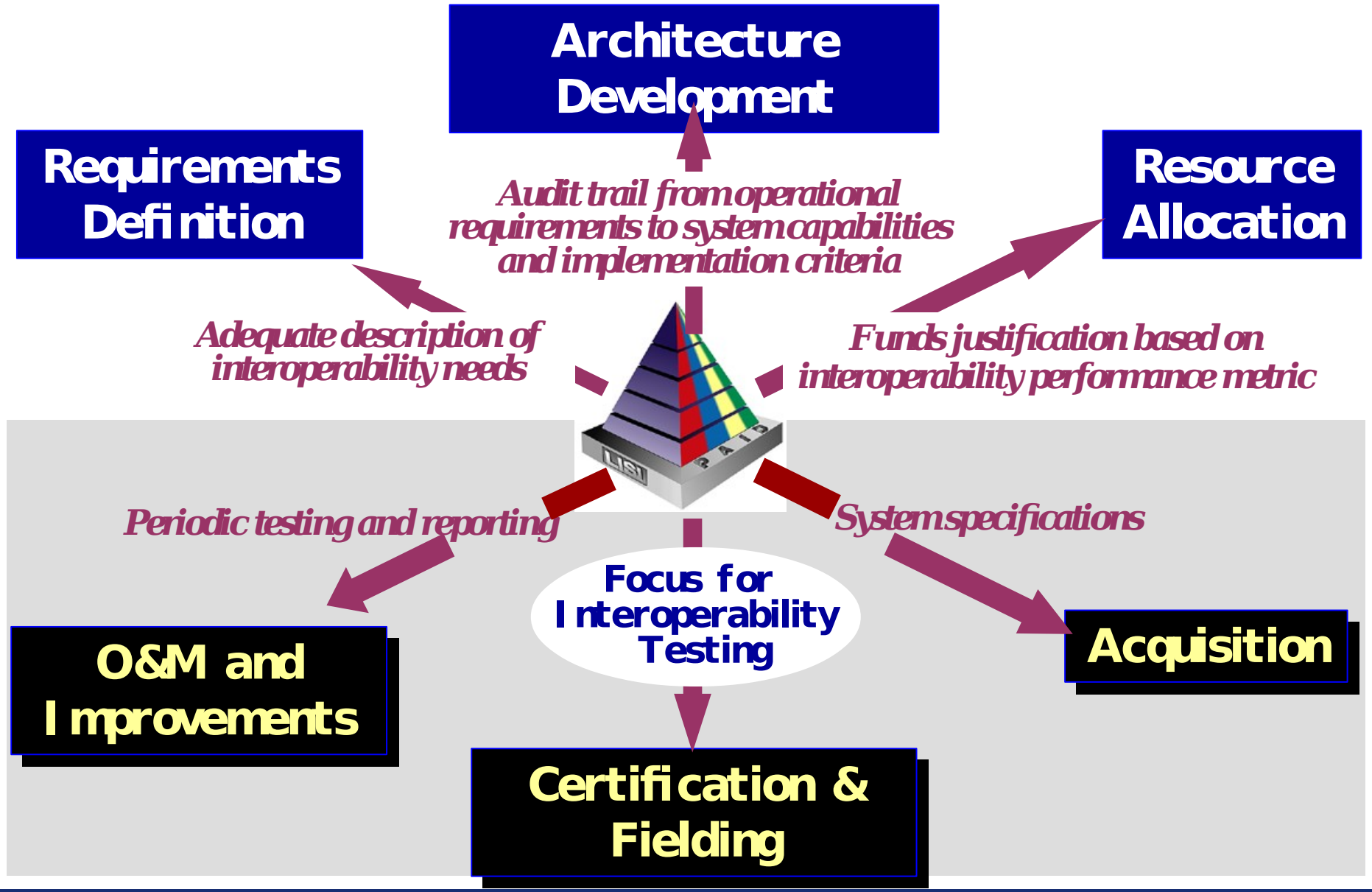
Sensor/Processor Deployed on WHEC



Warning: Ship's classified message center accepted only 5-1/4" disks !

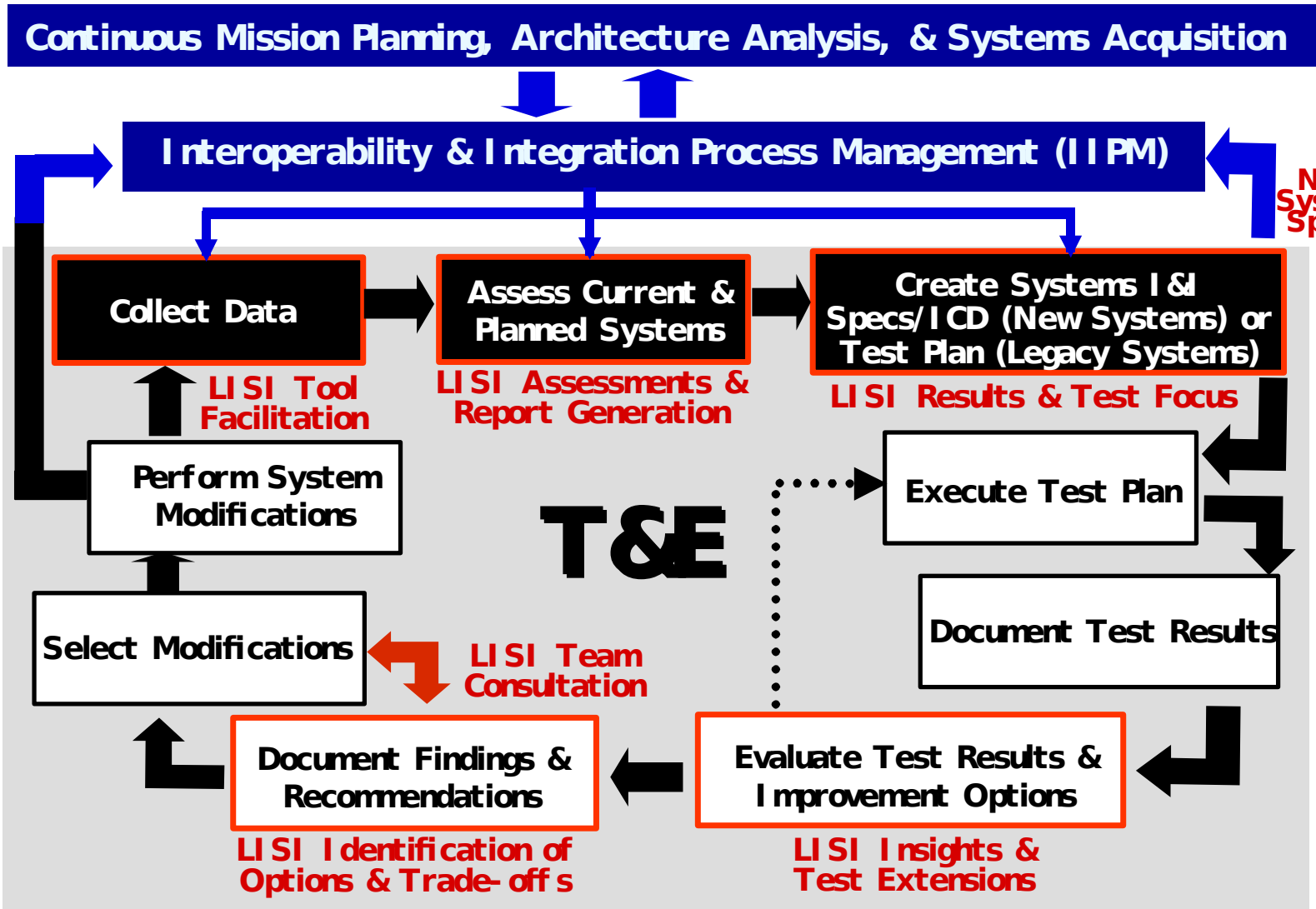
MITRE

LISI Applies Throughout the System Acquisition Life Cycle



USCG Planned Instantiation

LISI-facilitated T&E Process


Continuous Mission Planning, Architecture Analysis, & Systems Acquisition
Interoperability & Integration Process Management (IIPM)
New System Specs
Collect Data
Assess Current & Planned Systems
Create Systems I&I Specs/ICD (New Systems) or Test Plan (Legacy Systems)
LISI Tool Facilitation
LISI Assessments & Report Generation
LISI Results & Test Focus
Perform System Modifications
T&E
Execute Test Plan
Document Test Results
Select Modifications
LISI Team Consultation
Document Findings & Recommendations
Evaluate Test Results & Improvement Options
LISI Identification of Options & Trade-offs
LISI Insights & Test Extensions

LISI T&E Lessons Learned

- LISI has proven to be valid for predicting systems interoperability extent and impediments
- LISI's results are only as valid as the accuracy and completeness of the system data collected
- The interactive nature of the LISI process promotes coordinated solutions among system developers
- Known problem areas can be addressed early in the planning and testing processes
- LISI is not a substitute for interoperability testing, but LISI *can* be used to focus the testing process
- LISI can economize the testing process (test different implementations and low-confidence conditions first; test clear gaps and disconnects in context with candidate solutions)

LISI & Inspector Roles & MITRE-Internal Strategy

Corporate Policy

- **Corporate Officers** champion use of LISI & *Inspector* throughout MITRE, and include in executive-level "What is MITRE?" briefing

LISI Evolution

- **G074** maintains responsibility to evolve LISI in coordination with MITRE User Consortium

Tool Custodian

- **G066** takes custodianship of *Inspector*, including Corporate and Government CM
- **G074** provides oversight of LISI aspects of *Inspector*, and controlls access IAW sponsor sensitivities
- **G066** maintains repository liaison with DISA and system POCs

Systems Repository

- **G074** maintains Corporate repository of systems data, where needed, with dependency decreasing as other department staff become proficient

LISI Analysis

- **G074 & G066**, in partnership with the MITRE Institute, establish and execute LISI and Inspector training program (with possible certification), including executive-level format, in-depth user "how to," and advanced workshops in results interpretation and insights

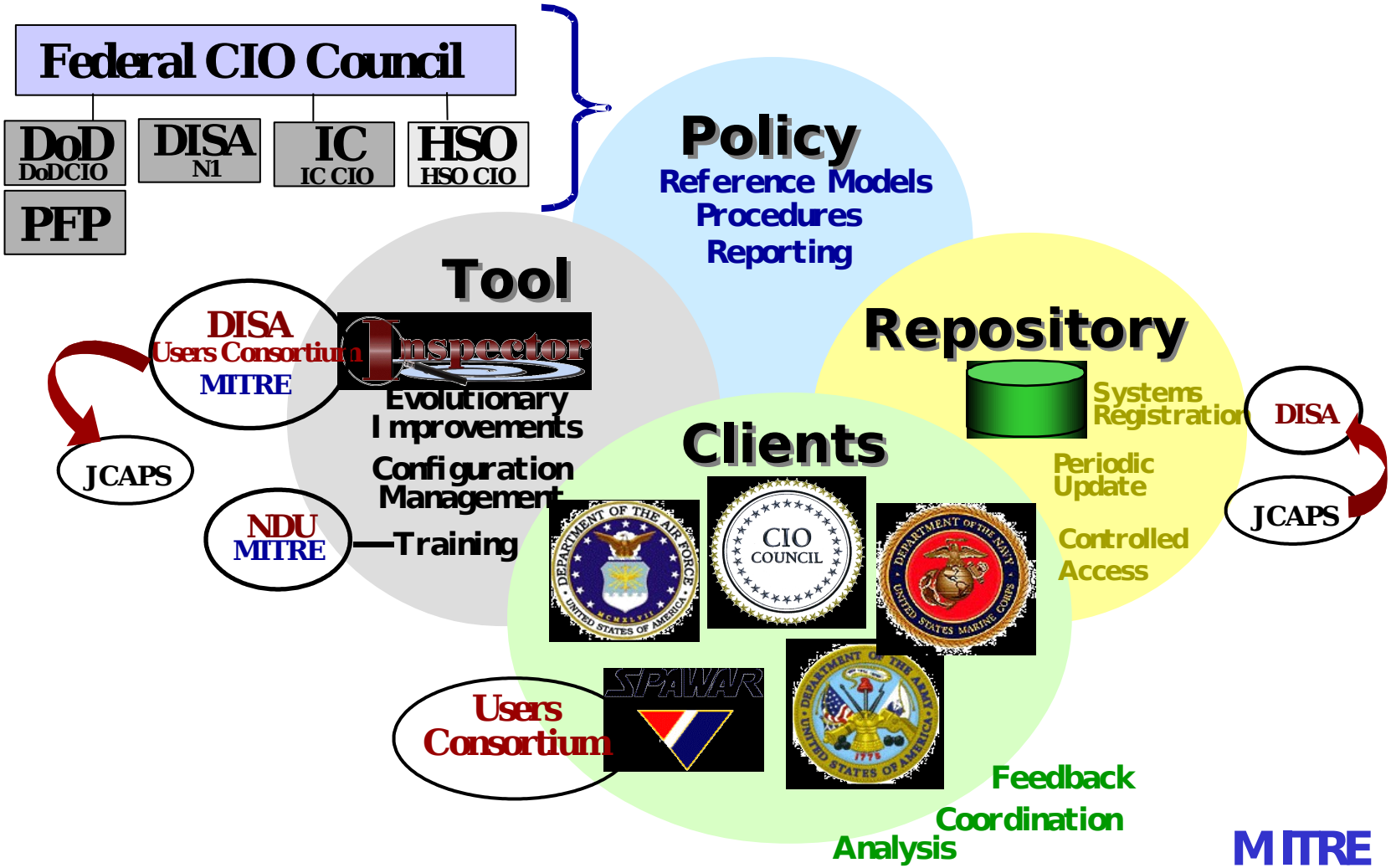
LISI & Inspector Training

Clients

WC3 CAASD CIIS CEM CAFC2S

- **All MITRE centers** that are dealing with information systems acquisition, improvements, and interoperability

Business Strategy for Government Formalization?



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